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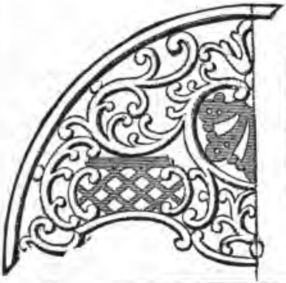
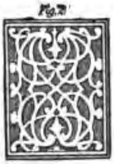
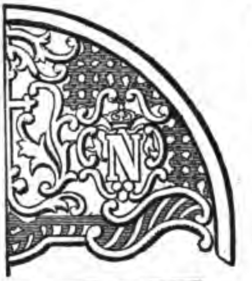
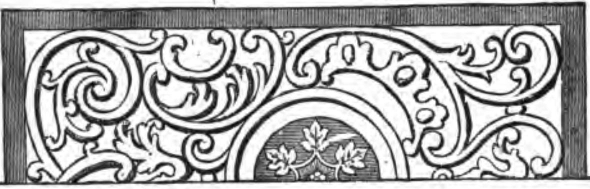


Fig. 2







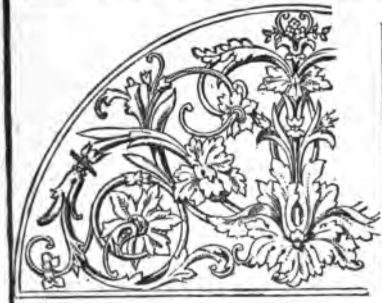


Fig. 6

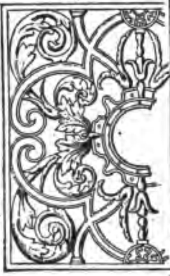


Fig. 7

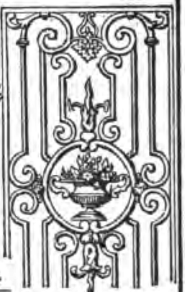


Fig. 8

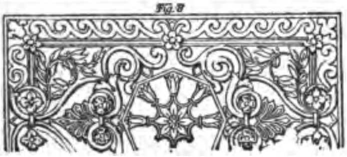
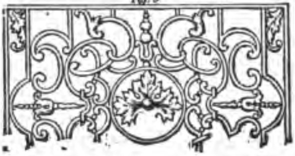


Fig. 9



Plaster and Plastering.

MORTARS AND CEMENTS,

HOW TO MAKE, AND HOW TO USE.

BEING A COMPLETE GUIDE FOR THE PLASTERER IN THE PREPARATION
AND APPLICATION OF ALL KINDS OF PLASTER, STUCCO, PORTLAND
CEMENT, HYDRAULIC CEMENTS, LIME OF TIEL, ROSENDALE AND
OTHER CEMENTS, WITH USEFUL AND PRACTICAL INFORMATION
ON THE CHEMISTRY, QUALITIES AND USES OF THE
VARIOUS KINDS OF LIMES AND CEMENTS. TOGETHER
WITH RULES FOR MEASURING,
COMPUTING, AND VALUING PLASTER
AND STUCCO WORK.

TO WHICH IS APPENDED
AN ILLUSTRATED GLOSSARY OF TERMS
USED IN PLASTERING, ETC.

BY

FRED. T. HODGSON.

:o:

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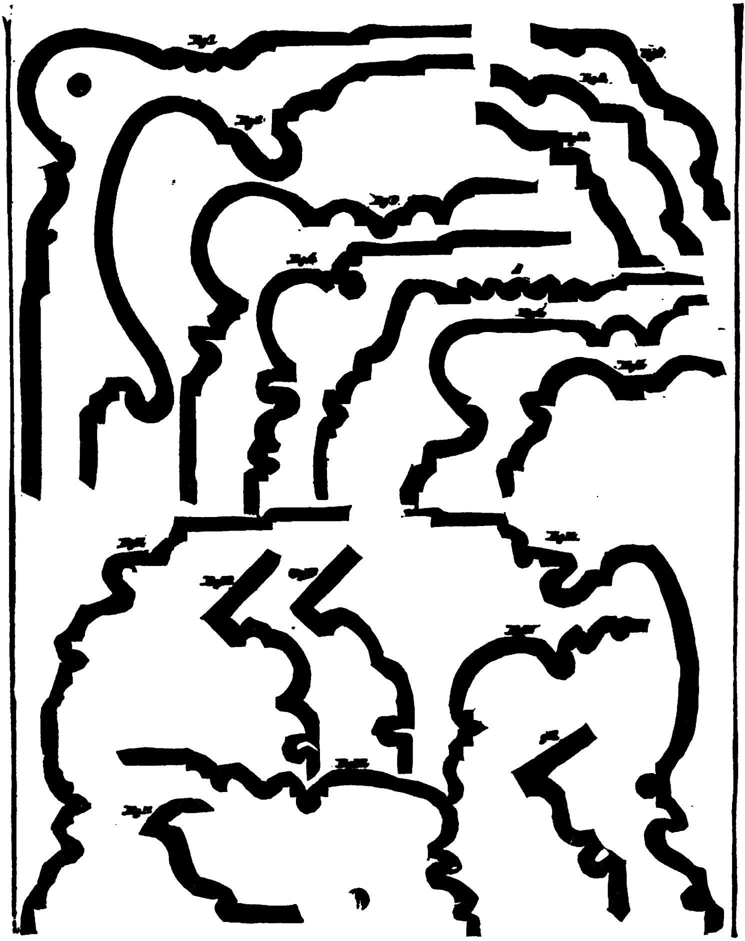

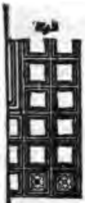

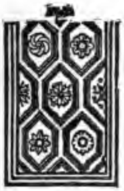

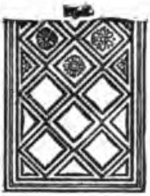

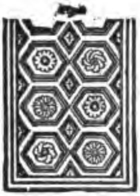

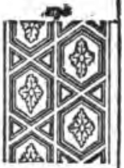

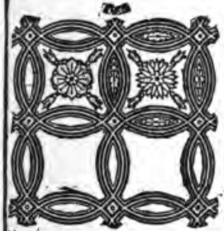

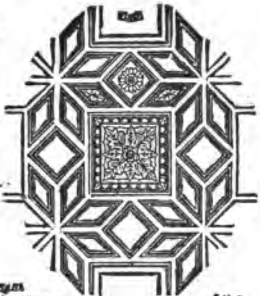

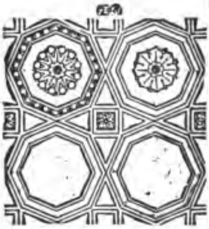

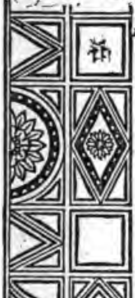

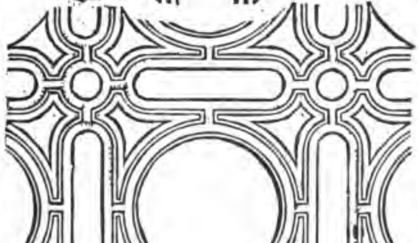

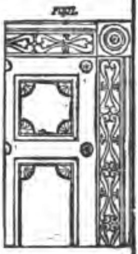

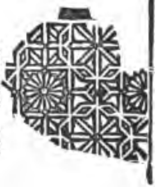

DESCRIPTION OF PLATES.

Frontispiece.

On this plate is shown a number of designs for ornamental plastering adapted for centre-pieces, corner-pieces, panels, or soffits. Fig. 1 is a very plain but effective ornament, suitable for a centre or for a circular panel. Fig. 2 makes a handsome panel for small work, particularly where the background is colored. Fig. 3 is a somewhat elaborate centre-piece; it is adapted for sacred concert halls, chapels or Sunday schools. Fig. 4 shows a design for a large panel. The design may also be used for a square centre-piece, where such is desirable. Fig. 5 shows a very ornamental piece of plaster work. It may be used in many places. Figs. 6, 7, 8 and 9 are square panels for various purposes. Fig. 7 makes an excellent panel for a dining-room wall, and, if properly painted in colors, has a very fine effect. Fig. 8 makes an excellent ornament for a recessed ceiling panel; a design something similar to it is used in the recessed ceiling panels of the Prescott Hotel, New York. Fig. 6 makes an excellent centre-piece for a small room where the sides of the wall are nearly the same length.

Plate I.

On this plate eighteen different designs for plaster cornices are shown. It is thought that from these designs the workman may be able to so combine them, where intact they are not suitable, so that they may be made available for any condition. Figs. 1, 2 and 3 are good designs for ordinary work, or where the general finish is not very elaborate or expensive. Figs. 5, 11, 15 and 16 are adapted for the Queen Anne style of architecture, now so much in vogue. Figs. 12, 13, 17 and 18 are suitable for marginal mouldings or other similar work. Figs. 6, 7, 8, 9, 10, 14 and 16 are adapted for general purposes, and will doubtless prove of value to the workman. Fig. 4 makes a very handsome cornice, and may be used with almost any style of architecture.

Plate II.

On this plate is shown twelve designs for ornamental plastering for panels and ceilings. These examples are drawn from a number of sources; they were first published in Berlin in a work entitled "Durrand's Parallel of Architecture." Figs. 1, 2, 3, 4, 5, 6, 7, 8 and 12 are designs from buildings in Palmyra. Fig. 11 is the arrangement of the panels of the ceiling in the BIBLIOTHÈQUE ANCIENNE, in Paris. Fig. 10 is from the Alhambra. Fig. 9 is a design in the Elizabethan style.

PREFACE.

There are very few manuals written for the plasterer, indeed, book makers, as a rule, seem to think that plasterers need no instructions; this, however, is a mistake; the art of plastering requires just as much skill and knowledge as the art of carpentry or masonry, and the field for improvement is just as extensive and as rich in results, if well cultivated, as in other and more pretentious pursuits.

The work herewith presented is designed by the writer to aid and assist the plasterer in acquiring a thorough knowledge of his trade, and to enable him to obtain a fair knowledge of the chemical constituents of the materials he employs, so that he may more intelligently use them, and thereby advance his own interests and those of his employers, and accomplish better results.

As no book, or number of books, can make a man a competent mechanic without experience, practice and handicraft, it is not expected that this book will make a man a plasterer without he has some previous knowledge of the trade; it is rather intended in this work to help those who are desirous of helping themselves; and to this end the writer has endeavored to render as plain as may be everything found between its covers.

The best authorities on the subject have been consulted and freely drawn from, and the practical experience and observations of the author have also been embodied in the work, so that while there is a great deal that is known to the old workman in the book, it is thought he will find in it something that will be new and of everyday use.

The Illustrated Glossary is a new idea in a work of this kind, and will, no doubt, be found of more or less value to the hard-working plasterer.

New York, 1883.

PLASTERS, MORTARS & CEMENTS

HOW TO MAKE, AND HOW TO USE.

Preliminary.—The art of plastering is of primary importance in building, more particularly as respects the interior of structures, in the finishing and decoration of which it has long formed a very prominent feature. The ease with which plaster can be made and handled, renders it one of the most useful of builder's materials, and the facilities it offers for ornamental purposes places the skilful workman in fair rivalry with the mason and sculptor.

The ordinary work of the plasterer consists in preparing and covering the walls and ceilings of buildings with a composition, of which the ground work is formed of wooden lath, wire netting, prepared iron sheets, base brick or stone walls, on which is spread lime and hair-mortar, finished with one or more coats of finer materials of different kinds, according to the description of work intended to be produced; but under the general term *plastering* is likewise included the execution of the several kinds of ornamental stucco work, together with the modelling and casting in plaster of-Paris, the various enrichments employed in the decoration of buildings. Formerly, the most elaborate enrichments of ceilings, cornices, panels, etc., were executed by hand; but from the facility with which cast work is executed, and its comparative cheapness—especially where a considerable number of ornaments are required—it has almost superseded the former method. Indeed, plaster, for ornate decoration, is very seldom used now, though there are cases where ornamental work is sometimes applied.

Experience and common sense teach us that ceilings and cornices are not only more economical, when simple and running in right lines, but that they are in better taste, less objectionable to the eye, absorb less light, and are much more easily kept clean. In all cases where the matter is left to the judgment of the plasterer, he should suggest plain moulded cornices and centre-pieces in all cases where an artist or architect has not suggested otherwise.

TOOLS AND MATERIALS.

The plasterer requires a variety of tools, many of them, such as moulds for running cornices, and centre moulds, may never be used only in the one piece of work, as the designs and styles of cornices and centres are continually changing. As these tools do not cost much, however, the changes do not fall heavily on the workman; but it is as well, whenever it can be done, to charge each mould against its own particular job of work. A good spade and shovel will be absolutely necessary to the plasterer's outfit, and will be among the first tools he will require. These should be light and strong, and well handled, or helved; after using they should have all the lime and mortar cleaned off them, and should be placed away where they will not be exposed to the weather.

The following list and descriptions of tools will give a new beginner an idea of the kind and character of tools he will be likely to require before he can successfully carry on the plastering business. Most of these tools will be illustrated further on:

The Hoe or Drag.—This is a tool so well known that it requires no description here. It is used chiefly for mixing hair in the mortar, and for loosing mortar when too "stiff," or when it has developed a tendency to "set." It is also used for preparing "putty" and fine "stuff."

The Hawk, which is a square board about thirteen inches square, with a short handle on the under side. It is used for holding stuff while the operator is at work. It is generally made of pine or some other light wood; it is made thin on the edges, being bevelled from the centre on the under side to each of the four

..dges; the handle should be about six inches long, and one and a half inches in diameter.

The Mortar-Board is a board similar to a table top, and is about forty inches square; it is made by jointing two or more boards together, which are secured by two battens, and screws or nails. It is used for holding the mortar delivered from the *hod* direct by the laborer.

Trowels, which are of two kinds; the ordinary trowel, which is formed of light steel four inches wide and about twelve inches long; this is the laying and smoothing tool, and is the most important in a plasterer's outfit. The other is termed a *guaging trowel*, and is used for guaging fine stuff for courses, etc.; it varies in size from three to seven inches in length.

Of Floats, which are used for *floating*, there are three kinds, viz., the *Darby*, which is single or double, as may be required; the single being for one man to use, the double for two. The single one should be four feet five inches long, and about four inches wide, with a handle near one end, like a hawk handle, and a cleat near the other end running lengthwise of the blade; the long darbys have a hawk handle on each end. The *hard float*, which is used in finishing, and the *quick float*, which is used in floating angles. The hard float is made of good pine, and has a semicircular handle on the back; a strip of hard wood is sometimes dovetailed into the blade, and the handle is screwed fast to the strip previous to the latter being driven in the dovetail; this is a good way, as there are no nails then driven through the blade, which, by the rapid wearing of the latter, would soon project above the blade and scratch the plaster where it was intended to have to have it smooth. The quick float is seldom used in this country; it is shaped like the angle it is intended to work down, and is a trifler handier for this purpose than the ordinary hard float.

Moulds.—These are used for running stucco cornices, and are infinite in shape and variety. The reverse of the contour of the cornice is cut out of sheet copper or iron, and is firmly attached to a piece of wood which is also cut out the reverse shape of the intended moulding. Their uses will be explained under the head of *Operations*. Moulds or matrices for leaves, flowers, or other ornaments, are made of plaster and glue, or beeswax; these will be discussed hereafter.

Centre-Moulds are made on the same principle as the reverse moulds for linear cornices, with an arm attached which is perforated at different radii to suit the diameter of centre-piece. Sometimes the moulds for cornicing are so formed, by placing the plates at an angle of forty-five degrees, that they will finish the cornice right into the angle and form the mitre; more frequently, however, the mitres are finished by hand.

The Pointer is nearly the same shape as a bricklayer's trowel, but is not so large, being only about four inches long. It is chiefly used for small jobbing, or mending broken or defective work.

The Paddle is simply a piece of pine wood less than three inches wide and six long, by one thick; it is made wedge shaped on one end, the other end being rounded off for a handle. Its use is to carry stuff into angles when finishing.

Stopping and Picking-out Tools, or, as they are frequently called, *Mitering Tools*, are made of fine steel plate, seven or eight inches long, and of various widths and shapes. They are used for modelling, and for finishing mitres and returns to cornices by hand where the moulds cannot work.

Mitering-Rod. - This is a tool one foot or more long, and about one-eighth of an inch thick, and three inches wide; the longest edge is sharp, and one end is bevelled off to about thirty degrees. It is used for cleaning out quirks in mouldings, angles and cornices.

The Operator also requires a good whitewashing brush with a short handle. The best should be obtained, as it will prove the cheapest in the end.

A Scratcher is generally made of short pieces of pine two inches wide and one inch thick; five or seven of them are nailed to two cleats, and are placed about an inch apart. The centre slat should be about eighteen inches longer than the others, so as to form a handle. The slats on the opposite end to the handle should be cut off square with one side and pointed. Its use is to make grooves, or bond in what is called the scratch coat. When completed it has somewhat the appearance of a gridiron.

Hod.—This is formed by two boards, eleven and twelve inches wide, respectively, and eighteen inches long, the wide board being nailed on the edge of the narrow one, making a right-angled trough; one end is enclosed, and the end piece is rounded over the top; the boards forming the sides are rounded at the opening. A handle about four feet long and two inches in diameter is then fastened about two inches forward of the middle nearer to the open end, and a piece of wood called a pad is fitted with a **V** groove on the angle just back of the handle. The object of this block is to prevent the arris of the hod from chafing the shoulder of the laborer. Much controversy has taken place among workmen at various times regarding the exact size of a hod, but this, I think, should be governed more by the strength of the person who has to use the particular hod than by any fixed rules. Hods for carrying mortar need not be so large as hods intended for carrying bricks.

Sieve.—This is used for straining through putty for finishing; it requires to be very fine for the purpose. Sometimes a hair sieve is used, but they are not lasting, and should never be used when a wire sieve is obtainable. Sometimes a hair sieve may prove convenient where dry plaster or cements have to be run through a sieve of some kind before it can be used; so, on the whole, the plasterer who desires a full and complete outfit, should provide himself with one good hair sieve, and at least two sieves of wire.

Sand Screens are usually twenty-two inches wide inside by about six feet long. On small work they are stood up at an angle of forty-five or more degrees, and the sand is shovelled against them; in some large works the screen is suspended, and one man shovels in the sand and a second one swings or shakes the screen. These screens, to be lasting, should have their sides and ends made of sheet iron, and the bottom should be formed with parallel rods of small round iron having wires running across them at regular intervals. These cross wires should be attached to the iron rods so as to hold them in place. The parallel rods may be placed at such distances from each other as will be most convenient for the work in hand.

Mortar Beds are made of rough lumber of any kind, and should be built partly in the ground, where circumstances will permit. They require to be strongly put together, as they have considerable weight to sustain. The writer has seen mortar beds built up with bricks and cement where large works have been under construction. Sometimes, master workmen, who do a large business, and who employ a great number of men, keep a large mortar bed or two in the rear yard of their shop and tool house, in which they keep always on hand a supply of ready-made stuff, which enables them to do small jobs or repairs at a moment's notice.

The Slack Box.—This is generally made of boards, and is eight or nine feet long, and from two to four feet wide, and twelve or sixteen inches in depth. An opening about eight inches square is left in one end, with a slide door attached, so that it can be opened or closed at pleasure. The opening should be covered on the inside with a grating, so that when the lime is run off no lumps or stones will get through. The grating may be made with iron rods, or may be formed with wooden laths or slats. The bottom of the box should be made as close and tight as rough boards will permit.

Lathing.—It frequently happens in towns and country places that the plasterer has to do his own lathing, or at least have it done under his own supervision, therefore it will be necessary to have something to say on this subject, and on the tools employed by the workman whose duty it is to prepare the walls for the plasterer. These tools need not be extravagant ones or many in number. They consist of the following:

Lather's Hatchet.—This is a small hatchet with a blade not more than one and a half inches wide, and rather larger in proportion than ordinary hatchets. The opposite end to the cutting edge is a hammer, with which the lather drives the nails. Sometimes the face of the hammer end is grooved, which makes it cling to the nails if the latter are not struck fairly on the head. An expert lather, however, will prefer a flat hammer face for driving lath nails. The cutting edge is used for "nipping" off laths when they are too long, or when short spaces of lathing are required to be made. In cutting lath with the hatchet, the workman gives the wood a short sharp blow with the tool at the point where the severance is required, and the lath is invariably cut at the first blow, if the operator is an expert.

Nail Pocket.—Perhaps the best nail pocket a lather can have is made from a portion of an old boot leg cut off to about four inches deep, and having a bottom of semi-circular shape made of wood, and to which the portion of the boot is fastened by means of broad-headed tacks. The pocket is fastened to the workman's waist by means of a strap, or other suitable device, and hangs in front of him in a convenient position. Sometimes nail pockets are made of canvas, but these are not so handy, as the top is apt to close and then the nails are difficult to get at. This never occurs with the boot-leg pocket.

Cut-off Saw.—A cross-cut saw is an indispensable tool to the lather for cutting lath in larger quantities for short spaces, and for rigging up platforms to work on, and for cutting supplementary studding or strips where such are necessary. The saw should have rather coarse teeth and have plenty of set. Usually, the lather thinks that almost any old used-up saw is good enough for his purpose, and we find him struggling away with all his strength cutting through a bundle of lath, when, if he had a saw that was worth anything—as a saw—he would perform his labors with about one-half the effort, and one-third of the time. It is all wrong to think of being able to work satisfactorily with inferior or imperfect tools. There is no economy in using tools of this kind, and any lather who fancies he is going to make or save anything by making use of an old buckled, mortar-stained saw, makes a terrible mistake. Get a good saw and keep it in good order, and it will pay you in two weeks.

MATERIALS EMPLOYED IN PLASTERING.

A great variety of compositions are used by plasterers, some of whtch I will endeavor to describe.

Internal Plastering.—Internal plastering is of two kinds, the one being executed in lath, the other on the bare walls. The latter description is termed rendering. The cements or mortars used for these purposes are of several kinds.

COARSE STUFF.—This is prepared in the same manner as common mortar prepared for bricklayers, with the addition of hair, which is incorporated therewith by the use of the rake or hoe. The hair used should be fresh and long, and equally distributed throughout the stuff, so that, if a finger be drawn across it, the hairs shall appear at least the sixteenth of an inch apart.

FINE STUFF is pure lime, slaked with a small quantity of water, and afterwards saturated to excess and put in barrels in a semi-fluid state, when it is allowed to settle and the water to evaporate. Sometimes a small quantity of hair is added.

PUTTY is lime dissolved in a small quantity of water, fresh lime being added from time to time, and the mixture stirred with a stick until the lime is entirely slaked, and the whole becomes of the consistence of cream; it is next sifted or run through a hair sieve, in order to separate the grosser parts of the lime, and is then fit for use. Putty differs from fine stuff inasmuch as it is prepared in a different manner, and always used without hair.

STUCCO, for internal work, is composed of fine stuff and very fine washed sand, in the proportion of one part of the latter to three of the former. All walls intended to be painted should be finished with this description of stucco.

LIME should always be chosen with great care, and if due attention is paid to the preparation, and sufficient labor bestowed on the use of it, the result will always be satisfactory. Great attention is required on the part of the plasterer in the preparation of his materials, more especially as regards the proper slaking of the lime, otherwise the work is liable to be disfigured by blisters and surface cracks.

PLASTER-OF-PARIS.—Another important article to the plasterer in the execution of his best works is plaster-of-Paris, of which mouldings and other decorations are made. When expedition is required, it is of the greatest service to mix with the mortar, as it causes the work to set as soon as it is laid on. The operation of mixing plaster-of-Paris with mortar is termed "gauging"; and the material so compounded is called "gauged stuff." Plaster-of-Paris being formed into a thin paste by the addition of water, quickly sets or becomes hard, and at the instant of its setting its bulk is increased; this expansion of the plaster, in passing from a soft to a hard state, is one of its most valuable qualities, rendering it an excellent material for filling cavities where other mixtures would shrink and leave vacuities, or entirely separate from the adjoining parts. This material is used for taking casts and impressions of figures, busts, medals, ornaments, etc.; and likewise for making the moulds in which they are formed.

LATHS.—Laths are simply thin strips of wood about 3/8 of an inch thick, and from one inch to one and a half inches in width, and are generally made either three or four feet in length; they are made of various kinds of wood, chiefly, however, of pine, cedar, hemlock, etc.

Cements, etc., used as Plasters.—Gypsum, the basis of most plasters, is a native hydrated sulphate of lime, occurring as a soft stone, usually of a more or less crystalline texture, and varying in color from white through shades of brown and grey to black. It is found in great abundance in the neighborhood of Paris, France, hence its name of "plaster-of-Paris."

The very fine-grained, pure white varieties, are termed "alabaster," or, when transparent, "selenites."

The raw stone is prepared either by simple calcination, or by calcination and combination with various salts of the alkalies.

Plaster-of-Paris is produced by the gentle calcination of gypsum to a point short of the expulsion of the whole of the moisture. The raw stone is sometimes ground in the first instance and calcined in iron vessels. Paste made from it sets in a few minutes, and attains its full strength in an hour or two. At the time of setting it expands in volume, which makes it valuable for filling up holes and other defects in ordinary work. It is also added to other compositions in order to make them harden more rapidly. It is also used for making all kinds of ornaments for ceilings, cornices, angle beads, etc., etc.; some of these are cast by forcing it, when in a pasty state, into moulds made of wax, plaster, or gutta-percha.

Where it is plentiful, as in the neighborhood of Paris, it is used in all parts of house construction, where it will be free from exposure to the weather, for which it is unfit, as it is very soluble in water.

There are three qualities of plaster-of-Paris in the market—the "*superfine*," "*fine*," and "*coarse;*" the two former being whiter and smoother in grain than the last. It is sold in this country in barrels, but in Europe the inferior qualities are sometimes put up in sacks containing two hundred pounds.

Limes.—The natural limes and cements used by the plasterer are all produced by the calcination of limestones or other calcareous minerals, the effect of which is to drive off the carbonic acid and moisture they contain.

Calcination is heating to redness in air.

Quicklime, or caustic lime, is the resulting lime as left immediately after calcination.

Slaking is the process of chemical combination of quicklime with water. This gives rise to various phenomena, for if the lime is treated with as much water as it will easily absorb, it almost immediately cracks, swells, and falls into a bulky powder with a hissing, crackling sound, slight explosions, and considerable evolution of heat and steam; but if the lime is pure, its volume will be increased from two to three and a half times its original bulk—the variation depending both on the density of the original carbonate and on the manner of conducting the process.

Air Slaking.—If the pure quicklime be exposed to the air, it will gradually absorb moisture, and fall into a powder with increase of volume, but without perceptible heating; it is then said to be "air-slaked." Some carbonic acid is also absorbed in "air slaking."

Slaked Lime is chemically known as the "hydrate of lime," or as calcium hydrate.

Hydraulicity.—Lime or cement is said to be more or less hydraulic, according to the extent to which paste or mortar made from it will set under water, or in position where it is free from access of air.

Limestones and other minerals from which limes and cements are powdered, differ greatly in their composition, ranging from pure carbonate of lime, such as white chalk or marble, to stones containing from ten to thirty per cent. of clay, in addition to other foreign constituents, such as magnesia, oxide of iron, etc., etc. As the properties of the resulting lime or cement depend very greatly upon the composition of the stone from which it is prepared, it would be instructive to the operator to read the works of Gilmore and Burnell on limes and cements, Dana's Mineralogy, and Dent's Chemistry.

Rich or Fat Limes are those calcined from pure or very nearly pure, carbonate of lime, not containing foreign constituents enough to have any appreciable effect upon either the slaking or setting actions.

The solubility and want of setting power of fat lime render it unsuitable for making mortar, except for the walls of outhouses and for other similar positions. It is, nevertheless, frequently used for the mortar in structures of a much more imposing character. It is, however, better than hydraulic limes for sanitary purposes, and is very useful for plastering and whitewashing. It is also extensively employed in the manufacture of artificial hydraulic limes and cements.

Precautions in Using.—Fat lime requires to be mixed with a great deal of sand to prevent excessive shrinkage, but this addition does not materially injure it, as it attains no strength worth mentioning under any circumstances. The only setting that takes place in it is the formation of a thin surface crust, bearing a small proportion of the whole bulk; mortar made from such lime may therefore be left and reworked repeatedly, without injury.

Poor Limes are those containing from sixty to ninety per cent. of carbonate of lime, together with useless inert ingredients, such as sand, which have no chemical action whatever upon the lime, and therefore do not impart to it any degree of hydraulicity. These limes slake sluggishly and imperfectly, the action only commences after an interval of from a few minutes to more than an hour after they are wetted, less water is required for the process, and it is attended with less heat and increase of volume than in the case of fat limes. If they contain a large proportion of impurities, or if they are over burnt, they cannot be depended upon to slake perfectly unless first reduced to powder. The resulting slaked lime is seldom completely pulverized—is only partially soluble in water, leaving a residue composed of the useless impurities, and without consistence. The paste formed from the slaked lime is more incoherent, and shrinks less in drying, but behaves in other respects like that made from fat limes—in fact, it is like a fat lime mortar containing a certain proportion of sand. Mortar made from poor lime is less economical than that from fat lime, owing to the former increasing less in slaking, bearing less sand, and requiring a more troublesome manipulation than the latter. It is in no way superior as regards setting, and should therefore only be used when no better can be obtained.

Hydraulic Limes are those containing, after calcination, enough quicklime to develop more or less the slaking action, together with sufficient of such foreign constituents as combine chemically with lime and water to confer an appreciable power of setting without drying, or access of air.

Their powers of setting vary considerably. The best of the class set and attain their full strength when kept immersed in water.

They are produced by the moderate calcination of stones containing from seventy-three to ninety-two per cent. of calcium carbonate, combined with a mixture of foreign constituents of a nature to produce hydraulicity. Different substances have their effect, but in the great majority of natural hydraulic limes, commonly used for making mortar, the constituent which confers hydraulicity is clay.

The phenomena connected with the slaking of limes varies greatly, according to their composition. With none is it so violent as with the pure carbonate of lime, and the more clay the limes contain the less energy do they display, until we arrive at those containing as much as thirty per cent. of clay, when hardly any effect at all is produced by wetting the calcined lime, unless it is first ground to a powder.

The setting properties of hydraulic lime also differ very considerably in proportion to the amount they contain of the clay or other constituents, which gives the lime its power of setting without drying or the access of air.

It will be gleaned from the foregoing that the white fat lime is the best for the plasterer's use. It works "cool," bears trowelling well, and is not so liable to crack and peel off as mortar made from the poorer limes.

The following statement of the characteristics of various kinds and qualities of lime and cement has been carefully compiled from recognized authorities on the subject, and is herewith given as being appropriate and in order:

1. The rich limes are the purest oxide of the metal calcium we possess, and the purer the carbonate of lime from which they are obtained, the more distinctly marked are the appearances from which they derive their name. These are that they augment in volume to twice their original bulk, or even more, when slaked in

the usual manner, and that they will not set (harden) under water if not mixed with any other mineral material, even though left immersed for years.

2. The poor limes are those which do not augment in bulk at all, or only to a trifling degree, when slaked. They do not set under water any more than the rich limes.

3. The moderately hydraulic limes set under water in from fifteen to twenty days, but do not become very hard. The change of bulk they undergo in slaking is the same as that of the poor limes, but never equal to that of the richer varieties.

4. The hydraulic limes set in from six to eight days' immersion, and continue to harden for some months.

5. The eminently hydraulic limes set within three or four days, and become quite hard in a month.

A classification of rocks with reference to chemical examination is as follows:

1. Pure calcareous rocks, or those containing from 1 to 6 per cent. of silex, alumina (common clay), magnesia, iron, etc., either separately or in combination, give rich limes upon being calcined.

2. The limestones containing soluble silica in the state of sand, magnesia, the oxides of iron and of manganese, in various respective quantities, but limited to between 15 and 30 per cent of the whole mass, yield poor limes.

3. The limestones containing silica in combination with alumina, magnesia and traces of the oxides of iron and manganese, in various respective proportions, but within the limits of from 8 to 10 per cent of the whole mass, yield moderately hydraulic limes.

4. When the above ingredients are present in the proportions of from 15 to 18 per cent., but the silica in its soluble form always predominating, the limestones yield a hydraulic lime.

5. When the limestones contain more than 20, and up to 30 per cent, of the above ingredients, but with the soluble silica in the proportion of at least one-half of them, the limestones yield eminently hydraulic limes.

Sand is known as "argillaceous," "siliceous," or "calcareous," according to its composition. It is procured from pits, shores of rivers, sea-shores, or by grinding sandstones.

Pit sand has an angular grain, and a porous rough surface, which makes it good for mortar, but it contains clay and other impurities. River sand is not so sharp or angular in its grit, the grains having been rounded and polished by attrition; it is very fine and of a whitish color, and is therefore well suited for plastering. Sea sand also is deficient in sharpness and grit from the same cause; it also contains alkaline salts, which attract moisture, and is therefore unfit for the plasterer's use. When sand contains lumps or stones it should be screened, or, if required of great fineness, passed through a sieve. Sand found to contain impurities, such as clay, loam, etc., which unfit it for almost every purpose, should be washed by being well stirred in a wooden trough having a current of water flowing through it which carries off the impurities. Sand, if good for the plasterer, will leave no stain when rubbed between the moist hands. Salts can be detected by the taste, and the size and sharpness of the grains can be judged of by the naked eye, or by the microscope.

Substitutes for Sand.—Burnt clay is sometimes used as a substitute for sand in mortar. It is prepared by piling moistened clay over a bonfire of coals or wood. As the clay becomes burnt, and the fire breaks through, fresh layers of clay and coal, or ashes, are piled on, and the heap may be kept burning until a sufficient supply has been obtained. The clay should be stiff. Care must be taken that it is thoroughly burnt. Raw or half-burnt pieces would seriously injure the mortar. Sand is sometimes very economically obtained by grinding the refuse "spalls" or chips left after working sandstones for walling, etc. It is generally clean if carefully collected, but the sharpness of its grit depends upon the nature of the stone from which it is procured. Scoriæ from iron works, slag from furnaces, clinkers from brick kilns, and cinders from coal, make capital substitutes for sand when they are quite clean and properly used. Brickdust is sometimes used as a substitute, but it is more frequently employed as a coloring material for mortars. When used for the latter purpose, well-burned bricks should be chosen to make the dust from, as the coloring material derived from poorly burned bricks is apt to fade and bleach.

Marble Dust is made use of sometimes for hard finishing. It should not be made too fine, as it will then not make good work; if left about as coarse as sand it will be found to give the best satisfaction.

Sawdust is used in some parts of France with success for outside work, and is said to stand the action of salt water and frost admirably. Owing to the elastic nature of sawdust it is well fitted to stand the expansion and contraction of the surrounding particles of mortar, by heat and cold, and thus prevent the cracking and peeling off of the mortar from outside work. We do not recommend its use, however, as we have our doubts as to its lasting qualities.

Hair.—The hair used by the plasterer in order to make his coarse stuff hang together is obtained from the tanner's yard or from the dealer. It should be long, sound, free from grease and dirt, thoroughly separated, beaten up, or switched with a lath, so as to separate the hairs, and thoroughly dried. It is classed according to quality; as Nos. 1, 2, and 3, the last being the best. A bushel weighs, when dry, about 15 pounds.

Colors.—Sometimes it is desirable to finish the whole or part of a wall in colors or tints; this can be done by mixing with the putty coat such coloring materials as are not affected by limes. Blues and blue tints may be obtained by using ultramarine blue, blue vitriol, or indigo. Blacks by using lamp black, powdered charcoal, or ivory black. Red and its tints by using vermilion, venetian red, or Indian red. Browns by using Spanish brown and the umbers. Yellows and all its tints, by using chrome yellow, or clay pulverized. Orange by a mixture of red and yellow. Green by a mixture of blue and yellow. And any color or tint that can be evolved by combining any of the foregoing colors.

Whitewash is made from pure white lime mixed with water. It is used for common walls, and for ceilings especially, where, for sanitary reasons, a frequent fresh application is considered preferable to any coating that would last better. It readily comes off when rubbed, will not stand rain, nor adhere well to very smooth or non-porous surfaces. It is cheap, and where used for sanitary reasons should be made up of hot lime and applied at once, under which conditions it also adheres better. Whitewash is improved by adding one pound of pure tallow—free from salt—to every bushel of lime.

Whiting is made by reducing pure white chalk to a fine powder. It is mixed with water and size, and used for whitening ceilings and inside walls. It will not stand the weather.

Saylor's Portland Cement.—This is a cement manufactured in this country, and is fully equal in quality to the imported material. An analysis of this cement shows it to be composed as follows: Silica, 22.04; alumina, 10.11; sesquioxide of iron, 1.61; sulphate of lime, 1.78; lime, 62.93; magnesia, 1.13; total, 99.60. Weight per barrel, 400 lbs. Weight per bushel about 118 lbs. One barrel contains 3½ bushels cement. One barrel cement measures 3′ 10″ cubic measure.

DIRECTIONS FOR USE AND MIXING. SIDEWALKS.—Sidewalks should be laid four inches thick, in two courses; first or bottom course three inches, second or finishing course one inch thick. The top should be laid before bottom is set. Prepare foundation on which to put concrete in good coarse gravel or chip stone, well rammed or leveled. Proportion for bottom, one part cement, four parts clean sharp *gravel*, mixing cement and gravel thoroughly in the dry state, add sufficient water from a sprinkler to make a dry mortar, place at once and thoroughly ram down. For top mix one part cement and one part clean sharp *sand;* mix well before adding water, add water as above to the consistency of plastic mortar.

CELLAR FLOORS.—*Usual thickness two and a half inches.* Bottom two inches thick; one part cement and six to ten parts gravel. Top, half inch thick; one part cement and two parts clean sharp sand.

STABLE FLOORS.—Mixture similar to sidewalks for heavy trucks and horses. Should traffic be light proportions could be reduced similar to *cellar floors*, but keep the thickness same as sidewalks, *four inches*.

MASTIC OR PLASTERING.—Should be in two coats, half inch thick complete; first coat one part cement, five parts sharp sand. Finishing coat, one part cement, one and a half parts sharp sand.

In all cases mix cement and sand thoroughly before adding water—being careful not to use an excess of the latter.

CONCRETE FOR HEAVY BUILDING FOUNDATIONS.—1 part Portland cement. 3 parts clean sharp sand. 5 parts chip stone (or coarse gravel).

In the above proportions one barrel of cement will lay a bed of concrete six (6) feet square and two (2) feet deep.

These proportions were used in the concrete foundations for the walls of the new Mutual Life Insurance Company's Building, site of Old Post Office, New York, Chas. W. Clinton, architect, Jos. Thompson, builder.

FOR CONCRETE BLOCKS FOR FOUNDATIONS FOR SEA WALLS.—1 part Portland cement. 2 parts clean sharp sand. 5 parts chip stone (or coarse gravel).

A gang of twenty men will lay twenty-two yards per day.

Sand and cement must be thoroughly mixed dry; add water gradually and mix to plastic mortar.

Lay sand in bottom of the bed, spreading cement over it, then turn over by hauling from one end of bed to the other three times. Then spread gravel in another bed, and throw this mortar over the gravel and thoroughly mix, turning over twice.

The above proportions and methods are used by the Department of Docks (also by Capt Eads at the Mississippi jetties) and were furnished by the Department of Docks.

CEMENT SEWER PIPE.—To cement sewer and drain pipe manufacturers we would suggest that they mix 1 barrel "Saylor's" Portland to 2 barrels common cement; this product of 1 Portland and 2 common will make a first-class pipe, mixed 1 part cement to 2 parts sand and gravel. Care should be taken to see that it is not too wet. Pipe makers would do well to consult the following parties: Joseph Sharp, Paterson, N. J. Central City Pipe Works, Syracuse, N. Y. The Rhode Island Cement Drain Pipe Co., Providence, R. I. J. W. Fitch & Son, Rome, N. Y. Knight, Wilson & Co., Brooklyn, N. Y.

The above parties use "Saylor's" Portland and "Anchor" Rosendale cements in about the proportions given.

WORK FOR WHICH PORTLAND CEMENT IS BEST ADAPTED.—Concrete blocks for sea walls. Concrete for foundations for heavy structures. Concrete for foundations for wharves and tramways. Concrete foundations for asphalt, macadamized, and paved roads. For breakwater and harbor work. Sidewalks, garden, lawn, and any outdoor walks. Cellar, stable, brewery and malt house floors, and any floor for heavy traffic. Coating of iron ships. Mastic, stuccoing or plastering. Reservoir, gas and water tanks. Mill dams and aqueduct work. For laying tile and marble floors. Cement drain pipe. Silos, ice houses, steep tubs, tannery vats. Artificial stone for buildings. Roofs, kitchen hearths, abutments of bridges, etc., etc.

Keene's Cement is a plaster produced by recalcining plaster-of-Paris after soaking it in a saturated solution of alum. It is made in two qualities; coarse and superfine. The latter is white, and capable of receiving a high polish; the former is not so white, or able to take so good a polish, but sets hard. It is imported, and is used for interior decorations, artificial marbles, cornices, centre-pieces, etc. When used for walls, the coarse should be used with equal parts of sand for scratch coat, and then finished with superfine; the walls, then, if the work is well done, will have a marble finish, and may be sponged with soft water without injury whenever they get soiled.

There are several other preparations occasionally used by the plasterer for coating walls, besides the ones mentioned, but they are not much known in this country.

External Plaster.—Mastics are by far the best for outside work, and when used on brick or stone work, will stand for years.

These are a species of cements consisting of powdered bricks, burnt clay, or limestone powdered, mixed with oil and litharge, or some other drier. They are applied with a brush, and always look well if well done. A coat of oil, now and again, keeps them fresh looking, and lengthens their period of service.

Metallic Cement has a metallic lustre, is suitable for outside work, and is intended to dispense with coloring or painting; it is not much in favor, however. It is made by mixing ground slag from copper-smelting works with ordinary cement stone. It is very durable.

Portland Cement Stucco is a mixture of Portland cement and chalk. It is of a good color and close texture; weaker than Portland cement, but not so liable to crack.

Lias Cement is produced from Lias shales containing a large proportion of soluble silica. It resembles Lias lime in appearance; sets in eight or ten minutes, and is used for lining water tanks, cisterns, or other purposes for which a light, quick-setting cement is required.

Stucco.—This term is very loosely applied to various substances which differ considerably from one another. These may be classed as follows: 1. Compounds of hydraulic lime, formerly much used for external covering to walls. 2. Mixtures of lime, plaster, and other materials for forming smooth surfaces on internal walls, chiefly those intended to be painted. 3. All sorts of calcareous cements and plasters used for covering walls.

Common Stucco consists of three parts clean sharp sand to one part of hydraulic lime. This makes a good plaster for outside work.

Trowelled Stucco is used for surfaces intended to be painted, and is composed of two-thirds fine stuff—without hair—and one-third very fine clean sand.

Bastard Stucco is of the same composition as trowelled stucco, with the addition of a little hair.

Rough Stucco contains a larger proportion of sand, which should, moreover, be of a coarser grit.

Rough Cast is composed of washed gravel mixed with hot hydraulic lime and water, and is applied when in a semi-fluid state. The gravel should not be larger than a pigeon's egg.

OPERATIONS.

Mortar for the plasterer's use should be well made, and the following rules should be strictly complied with: 1st. The lime should be thoroughly slaked, and brought to a paste or putty state. 2d. It should remain in the mortar bed until it is perfectly cool before mixing in the sand and hair. 3d. Good mortar can be used with safety eight or ten days after it is made, but in no case should it be used before it is six days old.*

In slaking lime, care should be taken that neither too much nor too little water is used. If too much is used the lime will be "chilled," and lose a part of its strength; if too little, it will "burn," and a portion of it will pass into the mortar bed unslaked, and cause trouble there

As the quality of lime varies in different localities, it is impossible to give the exact proportion of sand to be used to each bushel of lime.†

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* Some authorities say it is best to use mortar for plastering within three or four days after it is first made. They claim that in mortar which stands ten or more days before using, the lime loses a portion of its strength, and the mortar becomes deteriorated thereby. This, to a certain extent, is true; but, notwithstanding the loss of strength by the lime, and the consequent deterioration of the mortar, every observant plasterer knows that walls coated with mortar made two or three weeks previous to using, stand better than those coated with "green" or freshly-made mortar. Newly-made mortar, immediately applied, frequently causes the walls to chip, crack, and become mottled. Mortar well tempered, and as well seasoned, works better and cooler than the hastily made new mortar, and invariably gives better satisfaction. Col. Gilmore, quoting from Vicat, and apparently endorsing the statement, says: It was supposed, for many years, that the longer the lime was slacked before it was used, the better mortar it would make. Recent experiments prove, however, that this is not the case with mixtures of fat lime and sand only. Better results are obtained with such mortars if the paste be mixed with the sand as soon as the slaked lime has become cold, and care should be taken to use no more water, in the process of extinction, than may be required to produce a thick pulp."

† In ordinary practice, the cohesion of the mortar is greatly impaired by too large a proportion of sand, which should not in general exceed two volumes for every volume of lime paste. The equivalents of such a composition, in the form most convenient for small operations, would be one cask of lime = 240 lbs. net = 8 cubic feet of stiff paste, and sixteen bushels of sand, damp, and measured loose, after the common custom of laborers."—GILMORE.

The hair should be mixed with the lime and sand at once, for mortar should never be wet up a second time. For the first coat on lath it will be necessary to use about two pounds of hair to every bushel of lime slaked, and the mortar should have only a sufficiency of sand in it to keep it from cracking while setting, as it requires to be "pasty" enough to stick firmly to the lath and "clinch" or "bond" securely between and behind them.

In many places the plasterer has also to lath the work he is to finish; when such is the case he should make it a rule to never have more than 3/8 of an inch key between each lath. Joints should be broken every sixteen inches, and more frequently if the conditions will admit. If twenty or thirty laths are nailed so that the ends all joint on one stud, it will soon show itself, as the plaster will certainly crack at that point when the studs dry and shrink. In lathing for outside work, if the building has been first boarded it is better to nail the lath on diagonally—say at an angle of about 45 degrees to the base of the building, and one inch apart; then cross these lath again at right angles, with another tier, nailing them on to the first lath, leaving spaces about three-fourths of an inch between them.

This method of lathing is a trifle more expensive (about one-fifth) than the ordinary way, but it insures good work, and if the frame of the house is well put together and firm, so that the wind will not rack it, the plastering will stand longer than clapboards or siding. This method of lathing is extensively adopted in Lower Canada and the maritime provinces, and where a little rye whiskey is used in the making of the mortar—say about one gallon to every twenty bushels of lime—into which it is thoroughly mixed, much strength and durability will be added. Many buildings, which are known to have been plastered fifty years ago, are as good now as they were when the work was first completed, where these precautions were taken.

For rendering, which is applying the first coat of mortar to bare brick, grout, or stone walls, the mortar will allow of more sand than when used on lath, and may be devoid of hair altogether; in second coats, also, more sand may be used than first coating on lath. Hair is seldom used in second coating.

For the third, or last coat, if hard finish, little or no sand is used, but when it is, it should be mixed with the putty just before using. Stucco, marble dust, or plaster-of-Paris, when used, should not be mixed with the putty until a few moments before using, and then the whole amount of finishing stuff prepared at one time should be no more than can be used up at once, for if left to stand any length of time it will "set" and become useless.

Besides the foregoing, we have deemed it necessary to add the following descriptions and methods of doing plastering work, as they will aid the workman in understanding what has already been said:

A *screed* is a style of lime and hair of about seven inches in width, gauged quite true by means of a straight edge. The *screeds* should be formed at about three or four feet from each other, or even closer for first-class work, and in a vertical direction on all the sides of the room; and the intervals between them are to be filled up with lime and hair till they are flush with the face of the screeds. The straight edge is then worked horizontally over the screeds, by which means any superfluous stuff which may project beyond them in the intervals will be removed, and a perfectly plain surface will be produced. This operation is called *floating*, and is occasionally applied to ceilings as well as to walls, wherever good work is required, the screeds being formed in the direction of the width of the apartment. This process requires considerable care and skill in the execution. The *setting* to floated work is performed in the same manner as rendering, but as it is employed for the best apartments, greater care is required, and about one-sixth part of plaster-of-Paris is added in order to make it set more speedily, and give it a more close and compact appearance; it likewise renders it more firm, and better fitted to receive such coloring as may be required when finished.

For floated stucco work the scratch or pricking-up coat cannot be too dry; but if the floating which is to receive the setting coat be too dry before the set is laid on, it will be liable to peel off or crack, so as to disfigure the work; particular attention should therefore be given to have the under coats in a due state of dryness when the external coats are laid on.

Trowelled stucco, which is a very neat kind of work, suitable for dining rooms, halls, galleries, staircases, etc., where the walls are intended to be painted, must be worked on a floated ground, and the floating should be perfectly dry before the stucco is applied.

The *stucco* being prepared as already described, is afterwards well beaten and tempered with clean water. The ground intended to be stuccoed is first prepared with a large trowel, and made as smooth and level as possible, and the stucco having been spread upon it to the extent of four or five feet square, the workman, with the float in one hand and a brush in the other, begins to rub it smooth with the float, having first sprinkled it with water from the brush; this he does in small portions at a time, and proceeds alternately sprinkling and rubbing the face of the stucco until the whole is completed. The water has the effect of hardening the face of the stucco, and when well floated, the stucco feels to the touch as smooth as glass. This kind of work is executed both on walls and on laths.

Render and set, or *rendering floated and set*, combines the foregoing processes, only no lathing is required.

Rendering is to be understood if a wall, whether of brick or stone, be covered with a coat of lime and hair. By *set*, is denoted a thin coat of fine stuff or putty laid upon the rendering in the same manner as described before. These operations are similar to those described for setting ceilings and partitions; and the floated and set is laid on the *rendering* in the same manner as before described in lathed work.

Cornices.—Cornices are either plain or ornamented. In order to execute a cornice according to a given design, it is necessary to prepare a mould of the several members, which mould is usually made of sheet brass, iron or steel, indented so as to represent exactly the forms and projections of the said members, and fixed into a wooden handle as previously described. If the projection of the cornice exceeds ten inches, it is requisite to fix up wooden *bracketing* to sustain the same. This consists of pieces of wood fastened to the wall, on which the cornice is to be formed, about a foot apart, to which laths are to be nailed; the whole is then covered with a rough coat of mortar, allowance being made for the thickness of the stuff necessary to form the cornice, for which about one inch and a quarter is generally sufficient. To run a cornice properly, two workmen are necessary, who must be provided with a pail or tub of *set* or putty, and a quantity of plaster-of-Paris. Previously to using the mould they gauge a straight line or *screed* on the wall and ceiling, formed of *putty* and *plaster*, and extending so far on each as to answer to the top and bottom of the cornice to be formed. On the screed thus formed on the wall, one or two slight pine straight-edges are nailed, and a notch or chase being likewise cut in the mould, forms a guide for it to run upon. When all is so far ready, the *putty* is to be mixed with about one-third of plaster-of-Paris, and rendered of a semi-fluid consistence by the addition of clean water. One of the workmen then takes two or three trowels full of the prepared putty on his hawk, which he holds in one hand, whilst with the other he spreads the stuff on the parts where the cornice is to be worked, the other workman occasionally applying the mould, to see where more or less of the material is required. When a sufficient quantity has been put on to fill up all the parts of the mould, the mould is worked backwards and forwards, being at the same time held firmly to the ceiling and wall, by which means the superfluous material is removed, and the contour of the cornice completed to the form required. Sometimes it is necessary to repeat this operation several times, in order to fill up such parts as are deficient in the former application.

When everything is prepared, it does not take the operators a great while to run the cornice of one side of a room, and it is desirable that the whole cornice between any two breaks or projections should be completed at the same time, so that the entire length may be uniform in shape and shade.

Oftentimes, when running heavy cornices, the stuff will get so stiff that it will be impossible to work it. On such occasions it is frequently necessary to sprinkle water on it with a brush, so as to keep it moist. Sometimes, when the cornice is large, it is necessary to use three or four moulds, which are applied in succession.

The mitres at the angles, both internal and external, are afterward finished by hand—an operation which tries the skill of the workman.

Ornamented cornices and other enrichments are formed, in the first place, in the manner already described, excepting that additional sinkings are left in parts of the plain mouldings to receive the several enrichments, which are cast in plaster-of-Paris, by means of moulds prepared for the purpose, and which will be described hereafter. All the ornaments, which are cast in plaster-of-Paris are previously modelled in clay, or some other tractable substance, from designs made for the purpose. It requires both skill, taste and judgment to make a good model for a plaster cast; but a certain measure of success is within the reach of any plasterer possessing an ordinary amount of perseverance and brains.

When the model is finished, it must be left until it hardens, when it is oiled all over and placed in a wooden box prepared purposely for it; the several parts are examined and touched up wherever required, and oiled again. The next operation is to pour melted wax into the box until the model is covered, when it is left to cool and fix itself. When cold and hard, it is turned upside down, and the wax mould easily separates from the clay model and becomes the matrix or mould for future castings. The wax moulds are so made that they will not cast more than a foot in length of ornament at a time, greater lengths being difficult to handle. The casts are made with the finest and purest of plaster-of-Paris, saturated with water; and the wax moulds *must* be well oiled before the plaster is poured in. When the intaglios or casts are first taken out of the mould, they must be handled with care, as they are not very firm; they must then be placed in the open air, or in a hot oven, where they will dry and become very hard. When hard enough to bear handling, they must be scraped and cleaned preparatory to being used.

Enriched friezes and *bas-reliefs* are formed in a similar manner to the ornaments just described, excepting that the wax mould is so formed as to allow of a ground of plaster being left behind the ornament of about half an inch in thickness; this is cast to the ornaments or figures, and strengthens and defends their proportions, as well as promotes their general effect, when fixed in the situation for which they are intended. The capitals of columns are produced by a similar process, but they require several moulds to complete them; still, there is no difficulty in producing them, but such as the ingenuity of the operator will readily overcome. In forming the Corinthian capital, it is necessary first to prepare the bell or vase, which must be so shaped as to promote a graceful effect in the foliage and volutes, for each of which, as well as the other details, separate and distinct cameos will be required. These are all cast separately, and afterwards attached to the bell or vase by means of liquid plaster-of-Paris.

External Plastering is either rough-cast or stucco. The first is a description of covering much cheaper than stucco, and is therefore seldom used on other than the most unpretending of houses. It is executed in the following manner: The building intended to be rough-cast is first covered, or, as it is technically called, *pricked up*, with a coat of lime and hair. When this is sufficiently dry, a second coat is laid on of the same material as the first, but as smooth as it can be spread; as fast as the workman finishes this surface, he is followed by a helper with a pail full of rough-cast, with which he bespatters the new plastering, and the whole is left to dry together. The rough-cast is composed of fine gravel and clean sand washed from all earthy particles, and mixed with pure lime and water till the whole is of a semi-fluid consistency; this is thrown on the wall with a wooden float, about five or six inches long, and as many wide, made of thin pine, and fitted to a pine handle. Whilst with this tool the workman throws on the rough-cast with his right hand, he holds in his left a whitewash brush, which he frequently dips in the rough cast and washes the parts he has bespattered, thus giving it a regular finished and uniform appearance.

Stucco is a description of plastering executed so as, when finished, to resemble stone. It is composed of various kinds of materials, and distinguished by different names. The process of working

Roman cement is nearly similar to that of other stucco, but no *roughing-in* coat is required, as with this cement the work is done by the finishing process of the other kinds. The staining of this stucco to represent masonry is done by diluting sulphuric acid (oil of vitriol) with water, and putting into the liquid ochres or other colors, to vary the tint according to the taste of the individual using it.

A good composition can be made by taking live sand, well washed, and ground lime or cement, mixed dry in proportion of three of the latter to one of the former. This mixture, when well incorporated together, should be secured in an air-tight cask or box till the moment it is wanted to be used. The process of preparing and using this stucco is as follows: first, the wall to be covered, if of brick, should be prepared by raking mortar out of the joints and indenting the surface with a sharp tool; all dust and other superfluous matter must be completely removed and the surface sprinkled with clean water; the walls are then ready to receive the first coat, which is called the roughing-in coat, which is effected by diluting to excess a quantity of the stucco in pails of water till it is a little stiffer than common whitewash, and then covering the whole surface of the wall therewith by means of a flat hog's-hair brush, after which it must be left till it becomes tolerably dry and hard; this will be apparent from its getting whiter and more transparent than when it was first laid on. A quantity of the stucco having been tempered and saturated with water, when deemed of a proper consistence, screeds, or styles, of about eight inches in width, must be formed at the extremities of the wall, from top to bottom; this should be done with accuracy, which must be proved with the plumb-rule and straight-edge, and subsequently the space between the screeds so formed must be filled in with similar ones, at distances of about five feet apart, over the entire surface of the wall, excepting where apertures are required to be left, when such an arrangement of the distance of the screeds must be made as may be found necessary. The next operation is to fill in the spaces between the screeds with the stucco, one after the other, applying the straight-edge from time to time in order to remove the superfluous stucco and leave the whole surface true and even. Should any of the spaces between the screeds be hollow and uneven after the first operation, more stucco must be added, and the application of the straight-edge repeated as often as may be found necessary, till the entire surface is made perfectly true. The finishing of this species of stucco consists in floating or hardening the surface by rubbing it with a wooden float and sprinkling it with water, meanwhile, till the stucco becomes perfectly smooth and hard. Cornices, mouldings and facies are formed in a similar manner to that usually adopted in common plastering, which has already been described; but it will be found necessary, in running mouldings with this stucco, to add a small quantity of plaster-of-Paris, in order to produce a greater degree of fixation whilst running or working the mould.

Mastic cement consists of earth and other substances that are insoluble in water, or nearly so, either in their natural state, or such as have been manufactured, as earthenware, china, etc. To these materials, when pulverized, are added the different oxides of lead, as litharge, gray oxide and minium—all reduced to a fine powder; to which again is added a quantity of pulverized glass or flint stones. The whole being intimately incorporated and made of a proper consistence, with some vegetable oil, as that of linseed, will form a durable stucco or plaster, impervious to the wet. The following is the proportion of the several ingredients: To any given weight of clean grit or river live sand, or pulverized earthenware or porcelain, add two-thirds of the weight of pulverized imperishable stone. Then to every five hundred and sixty pounds of this mixture add forty pounds of litharge, two pounds of pulverized glass or flint stones, one pound of minium, and two pounds of gray oxide of lead. The whole should be thoroughly mixed together and sifted through a sieve, the fineness of which will depend on the different purposes for which the cement is intended; it should be put into casks, and it will keep for any length of time. The following is the method of using it: To every thirty pounds weight of the cement add one quart of oil—either linseed, walnut, or any other vegetable oil—and mix it together as any other mortar, pressing it gently together either by treading on it or with a trowel; it will then have the appearance of moistened sand, and as it soon hardens, care must be taken that no more be mixed at one time than is requisite for the present use. Previously to applying the cement to the wall, especially if of brick, the wall must be brushed with oil. If the cement is to be used on wood, lead, or anything of a similar nature, less oil may be used in the mixing of it.

A good marble plaster is composed of gypsum and alum, and is remarkable for its susceptibility of polish. There are several qualities of it. The coarser qualities form a paving scarcely distinguished from stone in color and hardness, but of one-third the price; the best white and finer qualities produce excellent imitations of Florentine and other mosaics. This cement is sold under the name of "Keene's marble cement." We have described it on page 27.

We will now endeavor to explain the manner in which the justly celebrated "Hindoo cement"—or "chunam," as the natives call it—is prepared and applied. For many years the manufacture and mode of applying this cement was kept a profound secret by the Hindoo workmen, and every attempt of Europeans to discover the constituents used in the manufacture, and the mode of application, was baffled by the sharpness of the natives, and it was not until analytical science was brought to bear on the subject that the matter became an open book. After the mystery became partly solved by the aid of science, the natives, seeing that silence was of no further use, voluntarily gave all the needed information, which we now reproduce in a condensed form.

There is no limit to the durability of this cement; it seems to be everlasting, and improves in appearance with age. The dressing is applied in one, two, or three coats, according to the quality required. For one coat work the composition is made up of one part of good lime, and one and three-quarter parts of fine river sand, free from salt; these must be thoroughly mixed, and well beaten up with water. Before applying the plaster the wall should be trimmed with a trowel, and swept perfectly clean, and then sprinkled with clean water. The wall being ready, the plaster is brought to the required consistency by being mixed with water in which the coarsest of brown sugar has been dissolved in the proportion of half a pound of sugar to one gallon of water. It is then laid on with a trowel, about half an inch thick, and levelled with a wooden rule, being afterwards smoothed with a wooden rubber or float till it acquires an even surface. During the process of rubbing the plaster is occasionally sprinkled with a little pure lime mixed with water, to give it a hard and even surface.

When two coats are required, the first coat is applied as already described, with the exception that the surface is left rough, and no pure lime is used during the process of rubbing. A day or two after the first coat is put on, and while it is still moist, the second coat is applied. The plaster used for the second coat consists of three parts of pure lime and one part of fine white sand. These are mixed as before, and afterwards ground on a flat stone with a small stone roller till they are reduced to a fine paste. The plaster thus prepared is laid on a wooden rubber, and applied with care over the first coat about an eighth of an inch thick. It is then rubbed down perfectly smooth with a small trowel, and afterwards polished with a crystal or smooth stone rubber, and as soon as it has acquired a polish a little very fine soapstone or steatite powder is sprinkled on it, to increase the whiteness and polish of the plaster. The polishing process must continue over the soapstone powder. The powdered steatite is tied up in a cloth and dusted on the wall, as pumice stone is applied to paper, by which means the finest parts are only used. The second coat must be finished on each wall on the day it is commenced, for it usually hardens too much during the night to admit of being polished the following day, unless the weather is very damp. The practice is to continue polishing the plaster until it is quite dry, and a number of extra hands are generally employed in order that it be well polished the first day. Moisture or "sweat" continues to exude from the plaster for some days after it is completed; this should be carefully wiped off with a cloth, and the wall kept perfectly dry till the plaster ceases to "sweat."

When three-coat work is desired the first coat is laid on as already described, but it is left three or four weeks to dry before the second coat is applied. The plaster for the second coat consists of one part of lime and one part of fine river sand, freed from the coarser particles and from clay by washing and sifting. It is mixed well, and beaten up in a clean trough, and applied over the first coat about a quarter of an inch in thickness, the first coat being previously moistened with a little water; it is next rubbed down in the same manner as the first coat, but acquires a much smoother surface, the plaster being of a finer quality. A day or two afterwards, before it has time to dry, the third coat is applied. This last coat consists of four parts of lime and one of white sand. These, after being well mixed, and reduced by grinding to a very fine paste, quite free from grittings, are put into a large earthen jar, of the size nearly of half a hogshead, and mixed with the whites of eggs and milk curds, in the proportion of twelve eggs and two quarts of curds, with the whey, to every half bushel of plaster; these are all well mixed and rubbed between the hands till the ingredients are thoroughly incorporated, and the composition reduced to a uniform consistent paste, a little thicker than cream and perfectly free from grittiness. The plaster is now fit for use, and is put on with a wooden float or rubber, about the tenth of an inch thick, and gently rubbed until it becomes perfectly smooth. Immediately after this another coat of still finer plaster is applied, consisting of pure lime ground to a fine paste, and afterwards mixed with water in a tub till it is of the consistence of cream; this is put on about a sixteenth of an inch thick, with a brush, and rubbed gently with a steel float till it acquires a slight degree of hardness; it is then rubbed with the crystal or stone rubber till a beautiful polish is produced, not forgetting to sprinkle the wall with fine soapstone powder during the process of polishing. If the plaster is not entirely dry on the second morning, the operation of polishing ought to be continued until the whole is quite dry. The moisture, as before directed, must be carefully wiped off, and the wall kept dry till all appearance of moisture ceases. The stone used in polishing is a crystal or white pebble, or piece of steatite, about three inches long and one and a quarter broad, with a perfectly smooth face. The quality of this marble coating depends chiefly on the plaster for the upper coat being reduced to a very fine paste, perfectly free from grittiness, and on its being, after it is applied to the wall, rubbed constantly with great care till it is quite dry and has acquired a very fine polish, all moisture being removed constantly as soon as it appears by wiping.

The "chunam," when properly made and properly applied, makes the best and most durable plaster work known, and age renders it harder, and, if possible, handsomer. There are buildings in India plastered several hundred years ago with this composition that still look like polished marble, and a blow struck with a hammer on its face simply splinters it, as a similar blow would plate glass. The Cathedral of Madras is covered with this material, the work was done over fifty years ago, and the plastering is said to be as good to-day as it was when first done, and not one rupee has been expended in repairs since the building was erected.

Scagliola.—A material called "Scagliola" is often used to imitate the finer kind of marble for the decoration of wall surfaces. It is composed of plaster, with alum and some color mixed into a paste, and afterwards beaten on a prepared surface with fragments of marble. It is, when properly prepared, very hard, durable, and susceptible of a fine polish. The surface on which it is to be placed has a rough coating of lime and hair. The plaster used in making the scagliola must be of the best plaster-of-Paris. It is only used when the finer kinds of marble are to be imitated; as many different shades of color must be mixed up separately as there are in the kind of marble to be imitated. As these colors have to be mixed up by hand, a good deal of skill is required on the part of the operator.

When the cement is laid on the prepared surface, and is properly hardened, the polishing is commenced by rubbing the surface with pumice stone, and cleaning it thereafter with a wet sponge. It is next rubbed with tripoli and charcoal, and thereafter with a felt rubber dipped in oil and tripoli, and finally finished off with felt dipped in oil only.

Carton Pierre is a material used for the making of raised ornaments for wall and roof decoration. It is composed of the pulp of paper mixed with whiting and glue, this being forced into plaster moulds backed with paper, and then removed to a drying room to harden. It is much stronger and lighter than common plaster-of-Paris ornaments, and is not so liable to chip or break if struck with anything.

Papier Mache is now largely used for ornamental purposes. It is prepared by laying sheets of brown paper one over another, and fastening them together by coats of glue between them. The sheets thus united are put in a metal mould and pressed to the shape of ornament required. When taken out, the object is trimmed where required and laid away until perfectly dry, when it is colored so suit the place it is designed for.

In the improved process of making ornaments of papier maché, a composition of pulp of paper and resin is first placed in the mould, the papier maché ornament, previously shaped or moulded as above described, is again put in the mould, and the pulp and resin adhering to the face of the paper produce a fine sharp surface.

Stamped Leather, and other pliable materials, are often used for ornamental and decorative purposes.

Stearate of Lime, as it is called, is now frequently employed for the finishing coat by those who know how to make it, but, as the knowledge of preparing this material is confined to a few knowing ones, it is not used as much as it deserves to be. The following method of making "Stearate of Lime," though known to many of our readers, perhaps, will be worth something to those who are not in the secret. Take a large barrel, leave the top end open, sink it two or two and a half feet in the ground, pound the earth solid around it so that it is firm; place a 4 x 4 scantling with a two-inch round hole in the centre through one of its sides, at the bottom of the barrel, and make it fast. Now have an upright shaft of wood, with one end rounded so as to fit easily into the round hole formed in the scantling. This shaft must be six or seven feet long, with a lever on the top about four feet long; arms must be mortised through that part of the shaft that remains in the barrel, and cleats or bars must be nailed on these arms perpendicularly, and all must be made so that it will revolve in the barrel with freedom. The upper end of the shaft must be secured by a gallows frame or otherwise, so that the lever fastened on its upper end can be worked without fouling with any of the attachments. The whole machine when finished will be somewhat similar to a "pug" or "clay-mill."

Now, for the "Stearate;" it will require one bushel of good lime, about twenty pounds of clean beef suet, which must be chopped very fine, and boiling water enough must be kept on hand to fill the barrel. It requires a man and a boy to prepare the material properly; the former to feed, first, lime, then suet, then hot water; then lime, suet, and hot water, and so on, until the barrel is full; and the latter to continually turn the mill, until the barrel is full and the ingredients thoroughly mixed.

The mode of application is quite simple. The walls are prepared in the usual manner, with a scratch coat, and a browning coat, the latter being "floated" with a "darby." When the last coat is sufficiently dry, the prepared "Stearate" may be applied "hot," with an ordinary whitewash brush, two coats generally being sufficient to make a first-class job.

The suet used in the manufacture of "Stearate" undergoes a chemical change when added to the lime and hot water, and combines with the lime in such a manner that it forms a kind of paint impervious to water, and outlasts, for the covering of brick, stone, or concrete, any oil paints employed for that purpose. The "Stearate" can be made to assume any hue desired, by the addition of any of the ordinary stainers, but it is more durable when used in its purity.

PLASTERER'S MEASUREMENT.

The Measuring and Valuation of plasterer's work is often conducted by the architect or his clerk. All common plastering is measured by the yard square, of nine feet; this includes the partitions and ceilings of rooms, stuccoing internally and externally, etc., etc. Cornices are measured by the foot superficial, girting their members with a tape line to ascertain their widths, which multiplied by their lengths, will produce the superficial contents. Running measure consists of beads, quirks, arrisses, and small mouldings. Ornamental cornices are frequently valued in this way; that is, by the running foot.

The labor in plasterer's work is frequently of more consideration than the materials; hence it becomes requisite to note down the exact time which is consumed in effecting particular portions, so that an adequate and proper value may be put upon the work.

Mensuration of Superfices.—The following simple rules will assist the operator very much in measuring walls, ceilings, etc.:

Triangle.—Multiply the base by half the perpendicular.

Equilateral Triangle.—Square of any side multiplied by .433.

Trapezoid.—Two parallel sides by perpendicular distance between them; divide by 2.

Parallelogram.—Multiply base by perpendicular.

Circle.—The area of a circle is found by multiplying the square of the diameter by .7854.

Ellipse.—The area of an ellipse is found by multiplying the transverse axis by conjugate axis, and the result by .7854.

Taking Dimensions.—In taking the dimensions of any triangular figure, make a sketch of it as in Fig. 1, No. 1, and on each line of the sketch mark the dimensions of the side of the figure it represents. Then, in describing the figure, either to its full dimensions, or to any proportionate scale, draw any straight line as A B, No. 2, and make it equal to the dimension marked on the corresponding line A B of the sketch No. 1. From the centre

A and with the radius A C, describe an arc at C; then from the centre B, with the radius B C, describe an arc intersecting the former; join A C, B C, and the triangle A C B is the figure required.

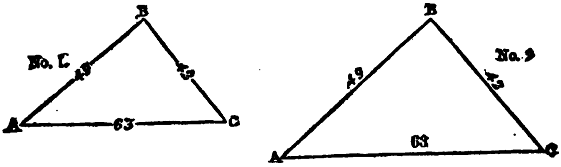


Fig. 1.

The dimensions of any figure are taken on the principle above illustrated. If the figure is not triangular, it is divided into triangles, in the manner shown by Fig. 2, Nos. 1 and 2.

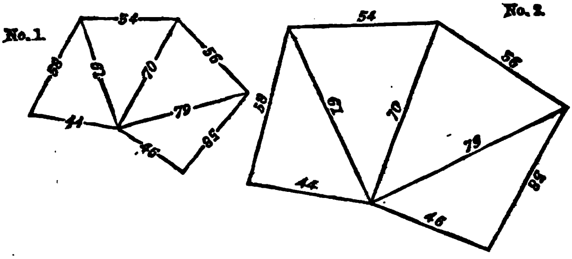


Fig. 2.

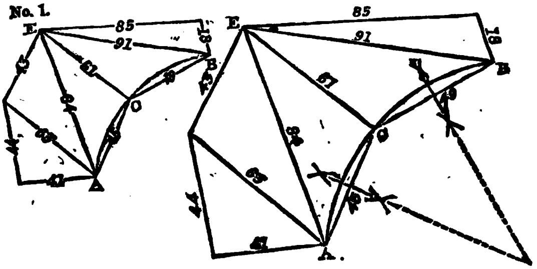


Fig. 3.

In Fig. 3, Nos. 1 and 2, the manner of taking dimensions, when one or more sides of the figure are bounded by curved lines, is illustrated. When, as at A B (No. 1), the side is a circular arc, its centre is obtained as follows: The extreme points A B, and the point of junction C of the intermediate line E C with A C and B C, give three points in the curve. From A and B, therefore, with any radius, describe arcs above and below the curve; from C, with the same radius, intersect these arcs; through the intersections draw straight lines meeting in D; and D is the centre of the curve, and D A, D B, or D C its radius.

The superficial area of almost any surface may be correctly ascertained if this system of measurement is pursued. Country plasterers are frequently paid "short" where there are angles, recesses, vaults and groins plastered, just because they are not "up" to taking these odd measurements. A very little study of the examples given will enable the workman to be in a position to take his own measurements, and thereby fix the amount justly due him.

Specification.—In preparing specifications for plastering, state number of coats and finishing in the different parts of building—if rendering on walls, say so. Specify description of laths, width, and distance to be placed apart for keying. State proportions of lime and sand for mortar, quirks cut, and angles if straight or curved.

Provide for cornices, centre flowers, pateras, panelled ceilings, arches, enriched keys, corbels, mouldings, and other ornaments.

State how angles and plastering are to be measured; plasterer to remove all his rubbish and make good all plaster work damaged by other workmen.

Whitewashing if required. State number of coats, etc., to be sized.

Plasterer's Work is usually charged by the *yard superficial.*

Rendering to Walls.—Take the length of the walls by the height, from the top of the skirting grounds to the ceiling; deduct for the doors, windows, etc., and half the depth of the cornice—if the cornices are bracketed, deduct the whole.

State the number of coats, if in mortar or cement, if set, floated and set, or as the case may be.

Take the number of beads or quirks as extra.

Lath and Plaster to Ceilings.—Take the dimensions from wall to wall, deduct the cornice at one side only. If the cornices are bracketed, deduct the whole.

State the number of coats, if floated or set.

Take friezes, soffits, etc., according to description, by the foot superficial.

Measure raised panels extra by the foot superficial.

Take the mouldings on the panel by the foot running, according to girth, and number the mitres.

Number pateras and ornamental work; give full description of each.

Lath and Plaster Work to Partitions.—Measure as described for rendering, If a cornice, deduct one-third of the depth, or if bracketed deduct the whole; give description as directed for ceilings.

Cornices.—Take the length around the wall, and deduct one projection of the cornice each way for the main length. If the girth of the moulding from the ceiling to the wall line is under 6 inches, take it by the foot running, stating the actual girth—and if over 6 inches, take it by the foot superficial.

If there are coves to the cornices, take them by the foot superficial.

Number all angles and mitres above four.

Take enrichments separate from the cornice, measure by the foot running, stating the girth, and if undercut.

Take quirks, arrises and beads by the foot running.

Number all the mitres to angles above four, stopped ends, etc., stating the girth, and whether the mitres are internal or external.

Pateras which save the mitering of enriched soffits not to be taken unless in a frame or coffer.

Plastering on brickwork to be measured from top of grounds to foot of cornice. On lath to clear height of wall; one-third the height of cornice above the foot of the moulding for stucco—and two-thirds for laid and floated work.

Dubbing out and roughing not to be allowed unless the work is out of an upright.

Stucco.—Take stucco by the yard superficial; state if bastard, trowelled on laths, or bricks, or as the case may be.

Take the reveals and narrow widths by the foot running.

Take quirks, arrises, and beads by the foot running.

Coloring and Lime-Whiting.—Take coloring and lime-whiting by the yard superficial, according to description.

Take the run of cornices and describe the girth.

Circular work keep separate.

Summary.—In addition to what has already been said, we deem it necessary to summarize as follows: Plastering on inside walls is generally done in three coats. The first is called the rough or scratch coat; it should consist of about 1 measure of lime to 4 of good sand, and 1/3 measure of hair; horse hair is said to make mortar more cohesive tnan cow hair. This coat should be from 1/2 to 3/8 inches thick, and should be pressed by the trowel with sufficient force to make it enter perfectly behind the laths to form a key. The laths should not be nailed closer than 1/4 an inch apart.

When the first coat has been on three or four days, it should be scored or scratched nearly through its thickness with lines diagonally across each other, about 2 to 3 inches apart. This gives a better hold to the second coat. The first coat should be thoroughly dry before putting on the second coat, but if the surface is too dry, it should be slightly damped as the second one is put on.

The second coat is put on about 1/4 to 3/8 inches thick, of the same coarse mortar or coarse stuff. Before it becomes hard, it should be run over with the scratcher to make the third coat adhere better.

The third coat, about 1/8 inch thick, contains no hair, and for giving it a white appearance more lime is used, say 2 of lime and 1 measure of plaster-of-Paris; if any sand is used, it must be of the finest kind. This coat is generally called hard finish or gauge stuff.

A third coat for outside work, sometimes called stucco, consists of 1 of sand to 2 of lime. Each of the third coats should be smoothed or polished, according to whether it is to show or be papered, painted, etc. The more thoroughly each coat is gone over with the water brush and trowel, which process is called hand floating, the firmer and stronger it will be.

A very good effect is produced in inferior rooms, by only two coats of plaster, in which fine cleaned screened gravel is used instead of sand; when lined in regular courses, it resembles a buff-colored sand stone of a very pleasant appearance.

To imitate granite on outer walls, after the second or smooth coat of plaster is dry, it receives one or two coats of lime wash, slightly tinted by a little umber or ochre, etc. Imitations of stone may be produced upon it in the usual way.

When brick walls are to be plastered, the joints should be left open or very rough to let the mortar adhere. The walls should be brushed clean of all dust and slightly damped before putting on the mortar.

Walls which are warped, or out of line, should be screeded, which is done by applying horizontal strips of the plaster mortar about 8 inches wide and from 2 to 4 feet apart all round the room. These are made to project from the first coat out to the intended face of the second one and while soft, are made perfectly straight and out of wind of each other by measuring of a straight-edge, etc. When dry the second coat is put on, filling up the broad horizontal spaces between them, and is readily brought to a perfectly flat surface, corresponding with the screeds, by means of long straight-edges extending over their surface.

The commonest kind of work consists of only one coat, and is called rendering, when on brickwork, and laying, if on laths. If a second coat be added, it becomes two-coat work, as render-set, or lath-lay or set. When the work is floated, it becomes three-coat work, and is render, float, and set for brick work, or lath, lay, float and set for ceilings and partitions; ceilings being set with fine stuff, with a little white hair, and walls intended for paper with fine stuff and sand; stucco must be used where the walls are intended to be painted.

In rough stuccoing halls, passages, or churches, or public buildings, in imitation of stone, the plaster should be mixed with a larger proportion of sand, and that of a coarser quality than trowelled stucco, and should not be smoothed, but left rough from the "darby" or hand float, which is covered with a piece of felt, to raise the grit of the same, in order to give the work an appearance of stone.

Rough Cast is a mode of finishing outside work, by dashing over the second coat of plastering, whilst quite wet, a layer of rough cast, composed of well-washed gravel, mixed up with pure lime and water, till the whole is in a semi-fluid state.

Pugging is lining the spaces between the floor joists with coarse stuff, to prevent the passage of sound, and this style is often called deafening.

As has been before stated, great care should be taken in preparing the mortar for the plasterer; the hair should be thoroughly incorporated, and the lime should be slaked beyond a peradventure. When the mortar is made and prepared in the bed, it should be left in that state for at least ten days, to "ripen;" the workman will soon discover that mortar which has been made a week or two will "work" much better than mortar newly made, or, as it is termed, "green mortar."

We may mention here, to the young plasterer, in his apprenticeship, the importance of his becoming acquainted with the art of designing ornaments belonging to his own work, such as mouldings, foliage and figures; and it is even important for him to acquaint himself with the art of modelling in clay, which is one of the greatest assistants he can engage—he will find the practice of it useful, for it will give him a readiness in finishing the returns and mitres of his work, where moulds cannot be used. Under the head of miscellaneous memoranda will be found several compositions for modelling, which have been thoroughly tested and approved of by experienced architects, and the manner in which they are used.

Whitewashing and Coloring.—Washes for internal and external work, though not properly belonging to the plasterer's routine, are often employed by him in finishing and coloring his work, therefore this work would be incomplete if it did not include a brief account of their constituents and use. Chief among the washes is the plain whitewash, which is one of the most valuable articles in the world when properly applied. It prevents not only the decay of wood, but conduces greatly to the healthiness of all buildings, whether of wood or stone. Outbuildings and fences, when not painted, should be supplied once or twice every year with a good coat of whitewash, which should be prepared in the following way: Take a clean, water-tight barrel, or other suitable cask, and put into it half a bushel of lime. Slake it by pouring water over it, boiling hot, and in sufficient quantity to cover it five inches deep, and stir it briskly till thoroughly slaked. When the slaking has been effected, dissolve it in water, and add two pounds of sulphate of zinc and one of common salt; they will cause the wash to harden, and prevent its cracking, which gives an unseemly appearance to the work. If desirable, a beautiful cream color may be given the mixture by adding three pounds of yellow ochre; or a good pearl or lead color by the addition of lamp, vine, or ivory black. For fawn color add four pounds of umber—Turkish or American, the latter is the cheapest—one pound of Indian red, and one pound of common lamp black. This wash may be applied with a common whitewash brush, and will be found much superior, both in appearance and durability, to common whitewash. For stone color, add four pounds of raw umber, and two pounds of lamp black. Care must be taken with the above mixtures, and the operator must see that all the ingredients are thoroughly amalgamated, or in application it will be found that the darker colors will be "streaky" or "cloudy," a result not very desirable.

A first-class wash for external work is formed by taking a shovelful of good lime, and slake it in about a quart of warm blood, fresh from the slaughter house. Add to this a sufficient quantity of beer grounds, or stale beer and skim milk, in equal parts, boiled together, to fill with the lime and blood an ordinary pail. Use no water, but add coloring at discretion. This wash will stand the weather better than oil paint. Another good mixture is made by taking one gallon of lime, slake with one gallon of skimmed milk; add a quarter of a pound of powdered alum, and one gallon of wood ashes, mixing all to the consistence of thick cream, with soft water, and adding coloring matter as required. On some occasions borax may be substituted for alum. This mixture is admirably adapted for new work, and the surface—if the work is well done—will have a very pleasing and pearl-like appearance.

For outside work: Take quicklime half a bushel; slake it, and add one pound of common salt, and half a pound of sulphate of zinc, and a gallon of sweet milk. Dissolve the salt and zinc before mixing; thin the whole to a proper consistence with water, and it is ready for use.

Another recipe, which has gained great favor in Germany, is spoken of as follows: "Good lime slaked with sour milk, and diluted with water till it is of about the consistency of ordinary whitewash, is recommended by the *Landwirth* as an excellent coating for woodwork. Fences, rafters, partitions, etc., are, it says, effectually protected against the weather for at least ten years, by this application. The casein of the milk in combination with the lime forms a permanent film, which dries so quickly in warm weather that heavy rains falling directly after it has been laid on will scarcely affect the work."

In making whitewash it is sometimes necessary to produce a kind of cheap paint. This requires oil. Drying oil—linseed-oil that has been boiled—should be mixed with the lime and water, immediately after slaking, in proper proportion, or a pint to a gallon. Other oils, or even fats, will answer for out-of-door work, but the drying will be slower. In this way, while the surface is whitewashed, it is in reality painted Being applied with the common brush made for the purpose, it may be quickly done and cheaply. Keeping in view the foregoing suggestions, there can be but little difficulty in supplying a good preparation that will cost little in either time or money. Common whiting is sometimes employed instead of the lime, or it is often mixed with the lime wash;

but this gives no particular gain, except that it may look a trifle whiter, and be somewhat finer in the grain.

The following is the method of preparing the celebrated Washington whitewash, the same as that used about the premises of the President's house at Washington:

Nice unslaked lime, half a bushel; slake it with boiling water, keeping it covered during the process to keep in the steam. Strain the liquid through a fine sieve or strainer, and add to it, salt, one peck, previously well dissolved in water; ground rice, three pounds, boiled to a thin paste, and stirred in boiling hot; Spanish whiting, half a pound; clean nice glue, one pound, which has previously been dissolved by soaking well, and then hanging over a slow fire, in a small kettle immersed in a larger one filled with water, the same as an ordinary glue pot. Now add five gallons of hot water to the mixture, stirring it well all the time. Let stand a few days, keeping it covered so that no dirt or dust can get into it. It should be applied hot. For this purpose it can be kept in a kettle on a portable furnace. Large or small brushes can be used, according to the neatness of the work required. This mixture is especially adapted for brick or stone, and will last as long on either of these materials as oil-paint.

Coloring matter dissolved in whiskey may be put in and made of any shade desired; Spanish brown stirred in will make red-pink, more or less deep, according to quantity. A delicate tinge of this is very pretty for inside walls. Finely pulverized common clay, well mixed with Spanish brown, makes a reddish stone color. Yellow ochre stirred in makes a yellow wash, but chrome yellow goes further, and makes a color that is generally esteemed much prettier. In all these cases the darkness of the shade, of course, is determined by the quantity of color used.

MISCELLANEOUS MEMORANDA.

Hard Hydraulic Cement.—Used with great success in covering terraces, lining basins, cementing stones, etc., resisting the filtration of water, and so hard that it scratches iron. It is formed of 63 parts well-burned bricks, and 7 parts litharge, pulverized and moistened with linseed oil. Moisten first the parts to which it is to be applied.

Colored Cements.—Soluble soda glass of 33° Baumé is to be thoroughly stirred and mixed with fine chalk and the coloring wished for well incorporated. In the course of 6 or 8 hours a hard cement will set which is capable of a great variety of uses.

Cement for Porcelain.—Gum arabic and enough plaster-of-Paris to form a sticky paste; apply with a brush and stick the fractured ends together. (Very strong.)

Brick-Dust Cement.—Ordinary brick dust, made from hard burned, finely pulverized bricks, and mixed with common lime and sand, is a good substitute for hydraulic cement. The proportion is, 1 part brick dust, 1 of lime, 2 of sand, mixed together dry and tempered with water in the usual way.

To Render Plaster Figures Durable.—First thoroughly dry the plaster figure; place it in a vessel and cover it with the cleanest linseed oil just warm; after twelve hours take it out, drain, and let it dry in a place free from dust; when dry it will look like wax.

To Harden Plaster.—Mix up the plaster-of-Paris with a weak solution of gum arabic (1 oz. to 1 pint of water), or, for common purposes, a weak solution of size, this not only renders the plaster harder but gives the surface a pleasing smoothness.

Mastic Cement for the Front of Houses.—Fifty parts, by measure, of clean dry sand; 50 of limestone (not burned) reduced to grains like sand or marble dust; and 10 parts of red lead, mixed with as much boiled linseed oil as will make it slightly moist. The bricks to receive it should be covered with three coats of boiled oil, laid on and suffered to dry before the mastic is put on. It is laid on with a trowel like plaster, but it is not so moist. It becomes hard as stone in a few months. Care must be exercised not to use too much oil.

Cement for the Outside of Brick Walls.—Cement for the outside of brick walls, to imitate stone, is made of clean sand, 90 parts; litharge, 5 parts; plaster-of-Paris, 5 parts; moistened with boiled linseed oil. The bricks should receive two or three coats of oil before the cement is applied.

To Mend Plaster Models.—Wax and resin or shellac varnish is recommended, or wet both surfaces with silex and allow it a few moments to dry.

Cheap Concrete Flooring.—Mix 3 bushels coal ashes from a blacksmith's shop with 2 bushels gas lime, and then add sufficient gas tar to make a stiff mortar. After spreading it sift fine sharp sand or gravel over it; then roll well. It will take a few days to get thoroughly hard. Autumn is the best time for laying it.

Composition for Taking Moulds.—3-4 pound of black resin; 1-2 pound hard tallow and 6 ounces beeswax.

To Make and Use Elastic Moulds.—12 pounds glue, well steeped, then put into a metallic vessel in a hot bath of boiling water; when fluid, add 3 lbs. molasses, well mixed by stirring. Make cylindrical vessel of tin so that the bust may stand upright in it an inch or so below the top edge—oil it well inside—paste a piece of strong paper over the bottom of the bust to prevent the fluid mixture from entering into it; and if it is composed of plaster put some sand in it to keep it down. Now pour in the mixture of glue and molasses, and let it stand 24 hours to cool; it can be taken out by inverting the vessel. The mould is then cut and drawn back on each side, when the bust can be removed. The mould can now be reclosed and bound round with a piece of strong paper; use a mixture of wax and resin, and occasionally a little tallow for the new bust when just on the point of setting, and a pretty cast will be the result.

Cheap Artificial Building Stone.—100 parts plaster-of-Paris; 10 parts hydraulic lime; 5 parts liquid glue; and 500 parts cold water; mix well and pour into moulds. They can be removed from the mould in half an hour. Expose to the air for two weeks, or until thoroughly dry. It is said to have the ring and hardness of solid rock, and 25 per cent. cheaper than stone where the material is cheap.

To Harden Imitation Alabaster with Alum.—Suspend the article by a silken cord or wire in a strong and perfectly clear solution of alum, letting it remain until the alum crystallizes on the surface, then polish with a *wet* cloth.

To Make Hard Plaster-of-Paris.—Mix with weak alum water instead of water, for casting, or a solution of 1½ or 2 oz. of gum-arabic to the pint of water; or a weak solution of ½ oz. of gum-arabic to the pint of water; for common purposes, a weak solution of size may be used.

To Make Artificial Marble FOR PAPER WEIGHTS OR OTHER FANCY ARTICLES.—Soak plaster-of-Paris in a solution of alum; bake it in an oven and then grind it to a powder. In using mix it with water, and to produce the clouds and veins stir in any dry color you wish. This will become very hard, and is susceptible of a high polish.

A Mortar CAPABLE OF RECEIVING A HIGH POLISH.—One pint pulverized marble; 1 do. chalk; 1 do. flint. Mixed together and sifted through a very fine sieve, to this add 1 part lime which has been slaked 3 months, and water sufficient to make into a paste; in this state spread over a coarse ground as thin as possible, and make smooth on surface. It may be polished, when dry, by Venetian talc.

Marbleworkers' Cement.—Flour of sulphur, 1 part; hydrochlorate of ammonia, 2 parts; iron filings, 16 parts; all parts reduced to a powder and securely preserved in closely stopped vessels. When to be employed take 20 parts very fine iron filings and 1 part of the above powder; mix them with sufficient water to form a manageable paste. In 20 days it becomes as hard as iron.

Masons' Cement THAT WILL NOT CRACK UNDER WATER. Equal parts of quicklime, pulverized baked bricks and wood ashes. Thoroughly mix, and dilute with sufficient olive oil to form a manageable paste. It immediately hardens, and does not crack.

Whitewash USED BY THE UNITED STATES GOVERNMENT. Slake half a bushel of unslaked lime with boiling water, keeping it covered during the process. Strain it and add a peck of salt dissolved in warm water, three pounds ground rice put in boiling water and boiled to a thin paste; half a pound Spanish whiting, and a pound of clean glue dissolved in warm water; mix well together and let it stand for several days. Put it on as hot as possible. This answers on wood, brick and stone nearly as well as oil paint, and is much cheaper.

Red Wash for Bricks.—1 ounce of glue in a gallon of water; while hot put in a piece of alum the size of an egg; half a pound of Venetian red and one pound of Spanish.

To Whiten Internal Walls.—A very superior material for whitening internal walls may be made in the following manner: Take a quantity of very fine lime, and, passing it through the finest sieve, place it in a vessel sufficiently large for the purpose, and filling it with water, thoroughly mix the lime and water with a wooden instrument so as to diffuse the whole of the solid material through the fluid; when this has been done, let the mixture stand for about four-and-twenty hours, so that the lime may be deposited, and then draw off the liquid, which will contain the impurities in the lime. Fill the vessel again and mix the ingredients as before, and draw the water off when the sediment has formed. The lime will then remain at the bottom of the vessel, and the impurities being withdrawn, it will be exceedingly white, so bright, indeed that it will be necessary to add a little Prussian blue, when the purified lime is mixed with turpentine, size, and a very small quantity of alum, a composition will be formed, which, when applied to the face of the wood, will have a peculiarly beautiful appearance. The wood will be greatly improved by rubbing it with a brush, not so stiff as to scratch it.

To Protect Wood AND BRICKWORK FROM DAMP WEATHER.—Take 3 pecks of lime, slaked in the air, 5 pecks of wood ashes, and 1 peck of white sand. Sift them fine and add linseed oil sufficient to use with a paint brush; thin the first coat, use it as thick as it will work for the second coat, grind it fine, or beat it in a trough.

Concrete.—The best proportions are 60 parts of coarse pebbles, 25 of rough sand, and 15 of lime. Others recommend 80 parts pebbles, 40 parts of river sand, and only ten of lime. The pebbles should not exceed half a pound each in weight.

Papier Mache.—Cuttings of paper boiled in water and beaten in a mortar till reduced to a paste and then boiled with a solution of gum-arabic or size; it can then be formed into toys, etc., by pressing it into moulds. When dry it is done over with a mixture of size and lampblack, and afterwards varnished.

Another Description.—Sweeping of waste of factories moistened with water and a little glue, and pressed into a brass mould, is *Papier Maché.*

Cuttings of cardboard, stewed to a pulp and ground to a consistency by steam rollers and cast in a plaster mould, are the constituents of *Carton Pierre.* The brown paper is softened in water sufficiently to allow it to be forced in the sharpest angles of a brass mould previously coated with a light skin of paper pulp which has been cast for the purpose.

For the *Carton Pierre* a mould is prepared in plaster, which takes to pieces in the ordinary way. This is, in ordinary cases, not filled up solid, but only carefully lined by hand pressure with a thickness varying from ¼ to ½ an inch with the pulp. It is allowed to dry for some time before being removed from the mould and afterwards dried in a drying room.

Plaster Ornaments.—2 lbs. best whiting; 1 lb. glue; ½ lb. linseed oil. Continually stir whilst warm until all are well incorporated. Let it cool, and then lay it on a stone covered with powdered whitening, and heat it until tough and of a firm consistence. It may be put by for use and covered with a wet cloth to keep it fresh. When wanted, cut a piece adapted to the size of the mould, into which force it with a screw.

Fibrous Plaster.—A combination of common plaster and canvas. The plaster is cast very thin, less than ¼ of an inch, in a mould, and then upon the back of it is laid the canvas, which becomes incorporated as it sets. The shape is supported to light strips of wood laid on at the same time.

Seven Colors for Staining Marble.—It is necessary to heat the marble hot, but not so hot as to injure it, the proper heat being that at which the colors nearly boil:—

Blue.—Alkaline indigo dye, or turnsole with alkali.

Red.—Dragon's blood in spirits of wine.

Yellow.—Gamboge in spirits of wine.

Gold Color.—Sal-ammoniac, sulphate of zinc, and verdigris, equal parts.

Green.—Sap-green, in spirits of potash.

Brown.—Tincture of logwood.

Crimson.—Alkanet root in turpentine.

Marble may be veined according to taste. To stain marble well is a difficult operation.

To Clean Marble.—Mix soft soap, solution of potash, and slaked lime to a paste. Spread it over the marble and leave it for a day or two, and then wash off.

To Take Wax Moulds from Plaster.—If the object from which the marble is to be obtained be composed of plaster-of-Paris, and the mould is to be of wax, first prepare the plaster mould with a thin coat of boiled linseed oil laid over with a camel's-hair brush until it is completely saturated. The object should be now laid aside until it is quite dry. Some prefer saturating it with water, which is best done by placing the medal back down in the water, but not allowing it to flow over the face, when the water will saturate it thoroughly by capillary attraction. Then take the wax mould. The wax must not be too hot. The plaster may be saturated with skimmed milk, and then dried; by repeating this twice the plaster assumes on the surface an appearance like marble.

Cement for Mouldings.—Is made of powdered whiting, 2 lbs.; glue, 1 lb., with half a pint of boiled linseed oil; thoroughly incorporate in a metal vessel of heat, and well beat together on a stone with whiting, till it has acquired the necessary consistency and toughness. It is kept moist under cloths till used. It is generally pressed into moulds.

Cement Floors for Cellars.—For making floors, the following method is said to produce very desirable results: 4 parts coarse gravel, or broken stone and sand, and 1 part each of lime and cement, are mixed in a shallow box, and well shovelled over from end to end. The sand, gravel and cement are mixed together dry. The lime is slaked separately, and mixed with just mortar enough to cement it well together. Six or eight inches of the mixture is then put on the bottom, and when well set another coating is put on, consisting of 1 part cement and 2 of sand. This will answer for making the bottom of a cistern that is to be cemented up directly upon the ground without a lining of bricks. This will also form a very good cellar floor. A cement of 1 part sand, 2 parts ashes, and three parts clay, mixed with oil, makes a very hard and durable substance like stone, and is said to resist the weather almost like marble.

Wash.—The following composition is often employed in India for protecting plaster exposed to the weather, viz.: 3 parts of linseed oil boiled, with one-sixth of its weight of litharge, and 1 part of wax; the surface must be perfectly dry before applying the mixture, which should be laid on hot with a brush.

Coloring in Distemper.—When whitewashing a new ceiling, no size or glue should be used; but if the ceiling is hot use a little soap with the wash. For an old scaly ceiling, first wash well with soft water; and should the whiting not cover, then use a little glue.

For walls it is always necessary to use more glue. A little linseed oil added to the color when thick improves its appearance and wear.

In coloring, whiting, being the basis, should be mixed in a separate vessel, and fully sufficient to cover the work intended to be done, when a quarter to half pound of any of the following colors will be found sufficient for a large room: Ultramarine blue (a beautiful color for stores); imperial blue; metallic oxide (lavender); Indian red (light lavender); rose pink (fades); magnesia green (the best green); chrome yellow; 2 or 3 lbs.; yellow ochre for kitchens.

Mortar.—Good weather-proof mortar is thus made: Three bushels of clean sand, mingled with half a bushel good lime and half a bushel cement. This mixture once set will resist all weathers.

Caution.—Many times the plasterer will be called upon to plaster a building before the sashes are put in their places, and when this is the case, it is usual to put rough boards, canvas or felting over the outside openings, to keep out the heat, wind or rain. These coverings, whatever they may be, should not be taken off until the glazed sashes are ready to take their places. There are two reasons for this: first, by opening the windows while the plastering is progressing, and admitting a draft, portions of the mortar would dry so rapidly that it would crack, warp and break bond; second, by taking off the coverings the building is left exposed to storms and sudden wind pressure, and if the wind cannot get out as rapidly as it enters, it is apt to carry the roof of the building away. We have known of several instances where buildings have been unroofed because the plasterers left the windows open on one side and closed on the other during a sudden storm.

Concrete Walls.—When the surface to be plastered is one of concrete, the mortar should be laid on while the concrete is yet moist, and if any part has been permitted to become dry, it should be well moistened with water before the application of the stucco. The mode of operation in plastering concrete is the same as with brickwork, the great requisite and difficulty in every case being to induce the mason to bestow labor on the process, and work the mortar well into the wall.

External Stucco.—The best stucco for outside work near the sea-shore consists of one part Tiel lime, two parts of chalk, and two of sand.

Proportions.—For a rich lime the best proportions of clean, sharp river san d is to 1 part slaked lime add 4 parts coarse sand, 3 parts fine sand, and 1/4 of the quantity of lime, of burnt bone ashes; the latter gives great tenacity and prevents it from ever cracking.

Puzzolana.—Is either artificial or natural.

The natural is found in situations which have been acted upon by subterranean heat. They all consist of silex, alumina, oxide of iron and a little lime.

The scoria of forges and furnaces, broken pottery and pulverized brick or tile, are artificial substances analogous to puzzolana.

From very rich slaked lime, with sand alone, or with puzzolana, which resists the action of sulphuric acid, we obtain a mortar which placed under pure water remains soft. Exposed to the air it acquires a crumbly consistence but never hardens.

If the same experiment be made with puzzolana readily decomposed by sulphuric acid, mortar is obtained which soon sets under water, but exposed to the air it quickly dries and never becomes very hard.

A little manganese added to mortar gives it the property of hardening under water.

Sharp coarse sand is the best for mortar; it should be divested by washing of all clay or mud. In drying, sand is not diminished in magnitude; but lime shrinks much, therefore the greater proportion of sand the sooner the mortar sets, and the harder it will be when dry.

The Romans use 3 of sand to 1 of lime.

If mortar is well beaten it will take a greater proportion of sand.

A mixture of coarse lime and fine sand makes the best mortar, and the addition of ¼ the quantity of lime, of burnt bone ashes, gives a greater degree of tenacity and causes it to dry without cracks.

Mortar should be made in a cellar or vault, and kept covered from air.

Grout.—A fluid cement for filling up irregular spaces; if made of mortar *that has been kept a long time*, and well beaten, it will set in a few days, but if new mortar, the grout will take time before it hardens, and perhaps never properly set.

If a certain portion of burnt clay be mixed with the lime in common mortar it will harden under water.

Other ingredients have been used for a similar purpose, such as coal ashes, wood ashes, cinders, pumice stone, puzzolana, etc. In the construction of the Eddystone Lighthouse, Mr. Smeaton used equal quantities of puzzolana and best lime, as the mixture best calculated to resist the action of the waves; in the proportions of two bushels of slaked lime to one bushel of puzzolana and three of good sand will form a good water cement.

Pebble mortar was much used by the Romans, and is of great utility when large quantities of mortar are required. Take 1 of puzzolana, 2 of coarse sand, 2 of fine sand, 8 of small pebbles, and 4 of screened lime.

Common mortar of asnes is made by mixing together 2 bushels of newly-slaked lime, 3 bushels of wood ashes, which, when cold, is to be well beaten. The oftener beaten before being used the better. It is an excellent mortar for resisting alternate moisture and dryness.

Plaster-of-Paris, with a proportion of one-tenth of rust of iron, makes a water cement which sets almost immediately, and is of great hardness. If boiled potatoes be incorporated with mortar of lime and sand, it will be much improved.

Weights of Materials.—The following shows the weight (avoirdupois) per cubic foot of various kinds of material: Average mortar, 106 pounds; water, 62½ pounds; loose earth, 95 pounds; common soil (compact), 124 pounds; clay (compact), about 135 pounds; clay, with stones, 160 pounds; brick, 125 pounds; lime, 64 pounds; sand (loose), 96 pounds. And the following shows the bulk of one ton of different substances in cubic feet: Sand, 28 cubic feet; earth (compact), 18 cubic feet; earth (loose), 32 cubic feet.

Items.—We give the following, which will convey some idea of the cost of plastering in some of the Western States. The quantities given are approximately correct, but the prices given are not to be relied upon:

The number of yards is simply the area of all the walls and ceilings.

One hundred yards of plastering will require 1,400 laths, 4½ bushels of lime, 18 bushels of sand, 9 pounds of hair, and 5 pounds of nails for two-coat work.

Three men and one helper will put on 450 yards, in a day's work, of two-coat work, and will put on a hard finish for 300 yards.

Retail cost of three-coat work for 100 yards of plastering:

Seven bushels of lime at 30 cts	$2 10
Four-fifths of a load of sand at $1.25	1 00
Nine pounds of hair at 65 cts	3 15
Five pounds of nails at 4½ cts	22
Lathing, 100 yds. at 2¼ cts	2 25
Plastering, 2 coats, 1 man ⅔ of a day	2 00
Helper, 1-5 of a day	33
Hard finished, 1 day's work	3 00
Making mortar and scaffolding	1 50
Total cost	$16 00

Or, sixteen cents per yard.

Cisterns.—Cisterns, whether built of stone or brick, or simply formed by digging a hole in the ground, should be plastered with good cement; the bricks or stones should also be laid in cement, as it makes much better work. Hard-burned bricks are the best for cisterns, as they do not soften on the outside by moisture.

The following is nearly correct, and is easily understood, and may prove useful in estimating for cisterns.

"One foot in depth:

3	feet	in diameter	contains	55¼	gallons.
3½	"	"	"	75	"
4	"	"	"	98	"
4½	"	"	"	124¼	"
5	"	"	"	153¼	"
5½	"	"	"	185½	"
6	"	"	"	220¾	"
7	"	"	"	300½	"
8	"	"	"	392½	"
9	"	"	"	497	"
10	"	"	"	613½	"

A gallon is required by law to contain eight pounds of pure water.

Multiply the gallons in the above table by the number of feet in depth of cistern, and you will get the contents nearly."

Blackboards for Schools, etc.—These are made in two ways: First, the wall is finished in the ordinary way, and then painted one or two coats with the following mixture: One lb. of shellac, one gal. of alcohol. Let the mixture stand a few days until the gum is dissolved, then mix in lamp black enough to give it "body;" add to the mixture half a pound of finely-pulverized pumice stone; apply to the wall with an ordinary paint brush. When dry it is ready for use. It will dry in ten minutes. Second, mix in the finishing coat sufficient lampblack previously dissolved in whiskey, to color it, then apply like ordinary finish; when dry, give the surface one or two coats of the preparation mentioned above. The first method is suitable for walls already plastered, but will not stand long, and must be renewed at least once a year. The second method, if properly done, will last for all time.

Concrete.—A good concrete is formed by using one part lime, two parts sand, and four parts gravel.

Lime.—It requires about two bushels of lime, made into fine stuff, to finish one hundred yards of plastering, and six bushels for coarse mortar. One bushel of hair, one load of sand, and about one-fourth of a barrel of plaster-of-Paris are required for the same number of yards. These propoıtions are only approximate, as they will vary with the qualities of materials.

Measuring Plasterer's Work.—The following was published in one of the leading building journals, a few years ago, and will not be out of place here: "Plastering is always measured by the square yard for all plain work, and by the foot superficial for all cornices of plain members, and by foot lineal for enriched or carved mouldings in cornices.

"By plain work is meant straight surfaces (like ordinary walls and ceilings), without regard to the style or quality of finish put upon the job. Any panelled work, whether on walls or ceilings, run with a mould, would be rated by the foot superficial.

"Different methods of valuing plastering find favor in different portions of the country. The following general rules are believed to be equitable and just to all parties:

"*First.*—Measure on all walls and ceilings the surface actually plastered, without deducting any grounds or any openings of less extent than seven superficial yards.

"*Second.*—Returns of chimney breasts, pilasters, and all strips of plastering less than 12 inches in width, measure as 12 inches wide; and where the plastering is finished down to the base, surbase, or wainscoting, add 6 inches to height of walls.

"*Third.*—In closets add one-half to the measurement. Raking ceilings and soffits of stairs, add one-half to measurement. Circular or elliptical work, charge two prices; domes or groined ceilings, three prices.

"*Fourth.*—For each 12 feet interior work is done further from the ground; then the first 12 feet, add five per cent. For outside work, add one per cent. for each foot the work is done, above the first 12 feet.

"Stucco work is generally governed by the following rules, viz.: Mouldings less than one foot girt are rated as one foot; over one foot, to be taken superficial. When work requires two moulds to run same cornice, add one-fifth. For each internal angle or mitre, add one foot to length of cornice; and for each external angle, add two feet. All small sections of cornice less than 12 inches long measure as 12 inches. For raking cornices, add one-half. Circular or elliptical work, double price; domes and groins, three prices. For enrichments of all kinds, a special price must be charged. The higher the work is above ground, the higher the charge must be; add at the rate of five per cent. for every 12 feet above the first 12 feet.

Notes.—The following facts may often prove of use to the plasterer:

"A load of mortar measures 1 cubic yard, or 27 cubic feet; requires 1 cubic yard of sand and nine bushels of lime, and will fill 30 hods.

"A bricklayer's hod, measuring 1 foot 4 inches by 9 inches equals 1,296 cubic inches in capacity, and contains 20 bricks.

"A single load of sand and other materials equals 1 cubic yard, or 27 cubic feet; and a double load equals twice that quantity.

"A measure of lime is a single load or cubic yard.

"One thousand bricks, closely stacked, occupy about 56 cubic feet.

"One thousand old bricks, cleaned, and closely stacked, occupy about 72 cubic feet.

"One foot superficial of gauged arches require 10 bricks.

"One foot superficial of facings requires 7 bricks.

"One yard of paving requires 36 stock bricks laid flat, or 52 on edge.

"Stock or place bricks commonly measure 8¾ inches by 4¼ inches by 2¾ inches, and weigh from 5 to 6 pounds each."

Mortars and Cements.—It is thought that the following, which is extracted from a lecture on the subject by Edward Ragnall, M.E., may prove of use to those who will have need of this book:

"I gave an analysis of the cement found at Dangan Castle, near Trim, in Meath, in my last article, and in continuing the subject I must say that I find a more than antiquarian interest attaches to it, from the fact that the Roman constructive works of the British

Isles have withstood the ravages of time more successfully than most of the Norman and mediæval architectural monuments reared in much later periods. This superiority has been generally attributed to great simplicity in point of construction, combined with the use of imperishable materials, such as flints and rubble, and to a skilful preparation of the mortar employed to bind the stones together.

"It is not quite understood what effects the admixture of sand has upon the tenacity or strength of cement, though many bricklayers assert that equal parts of sand and cement have nearly the strength of the neat material. This assumption, according to some, is not based on experiment, which shows that the addition of sand diminishes the tenacity of the cement in a quadruple ratio, and it is found equal parts of sand and cement mixed together have only the fourth part of the strength of pure cement. It is evident, therefore, that economy is the only advantage gained. When used pure, after 20 days' exposure to the air, the resistance to rupture of pure cement is about 54 pounds per square inch; according to one authority, when the proportion of sand and cement are equal it falls to 27 pounds, and when the proportion is half to one of cement the resistance is 37 pounds. These results are somewhat different, but they may arise from differences of cement and modes of investigation. Rondelet observes that the resistance to crushing is three times the resistance to traction. The only advantage of using sand with cement is, that when it is exposed to the air, as in the face of a wall, it is less liable to crack and shrink from unequal drying.

In all cases where this exposure is not necessitated, and where great strength is required, pure cement is the best; and it would seem that the most desirable mode of using natural cements is to employ them without sand in hydraulic works, or wherever great strength is the desideratum. For works exposed to dampness 2 to 3 of cement is a good mixture, and this is a good proportion for architectural purposes. For face work, 3 of sand to 2 of cement may be employed. The following data from Rondelet, given by Rankine, may be found useful, the mixtures being one year and a half old:

	Crushing force in lbs. per sq. inch.
Mortar of lime and river sand	**440**
Beaten	**600**
Mortar of lime and pit sand	**580**
Beaten	**800**
Hydraulic mortar of lime and pounded tiles	**680**
Beaten	**930**
Beton or concrete of mortar and broken flints	**420**

"Sixteen years after mixture the increase of strength is found to be for common mortar one-eighth, and for hydraulic mortar one-fourth. For tenacity, hydraulic lime, according to Vicat, one year after mixture, attains from 170 pounds per square inch in the best to 100 pounds in the ordinary kind, and mortar 50 pounds to the square inch for the best, and 20 pounds for the worst.

"French chemists have been giving a good deal of attention of late years to the subject of mortars and cements.

"M. Stanislas Ferrand, a Paris architect, has taken up the question very seriously, and besides articles in the scientific and technical journals, has produced a small work, in which the relative values of ancient and modern cement are carefully weighed.

"M. Ferrand absolutely refuses to allow that old Roman cement was even tolerably good. He denies moreover, that the Romans were the inventors, or that they had any secret method of making their mortars or cements. He declares them to be inferior to those of our own time, and concludes that the hardness which they exhibit is due—1, to the Roman system of building; 2, to the care with which their mortar and cement were prepared; and 3, to the time which has elapsed since they were used, and supposes that the Romans learned the art of cement making, as well as architecture, from the ancient Etruscans. This argument does not come within the scope of our notice, but we recommend it to the attention of archæologists.

"M. Ferrand asserts that the Romans never understood the manufacture of cement from argillaceous lime-stone, but made it, as the ancient Etruscans did, from slaked lime and burnt clay. Puzzolana, which possesses remarkable hydraulic qualities, played an important part in Roman mortars; when mixed with slaked lime, these volcanic ashes produced a highly hydraulic cement, which hardened by contact with air and water. Vitruvius has described the qualities of puzzolana at some length.

"The following have been found, by chemical analysis, to be the composition of the Roman cements or mortars, found in Paris:

"*The Roman Palais des Fermes.*—Lime, 65.70; silex, 4.000; alumina, 4.20; burnt and ground clay, bricks or tiles, 26.10. Total, 100.00.

"*The Aqueduct of Arcueil.*—Lime, 61.00; silex, 5.00; alumina 11.00; burnt clay, nil; silicious sand, 23.00. Total, 100.00.

"*The Wall of Paris, built by Philippe Auguste.*—Lime, 67.00; silex, 8.00; alumina, 7.00; silicious sand, 18.00. Total, 100.00.

"*The Circus of the Old Abbey of Saint Victor.*—Lime, 64.00; silex, 3.50; alumina, 4.50; silicious sand, 28. Total, 100.00.

"*The Ruins of St. Germain des pres.*—Lime, 67.50; silex, 4.00; alumina, 9.20; silicious sand, 19.30. Total, 100.00.

"According to these analyses, the famous Roman cement appears in all its simplicity. It is always a poor carbonate of lime, not hydraulic, deprived of its carbonic acid by heat, slaked and generally mixed with sand. It is only when the silica amounts to six per cent. that the cement becomes sensibly hydraulic. The method of manufacture is described by Vitruvius. The lime was slaked, as is now sometimes done, by plunging a basketful of it into water and withdrawing it instantly; this is called slaking by immersion. The carbonate of lime, thus converted into hydrate, was usually mixed with sand without regard to size; that is to say, unscreened, the quantity varying from 20 to 25 per cent. Sometimes the sand was replaced by broken bricks and tiles; in the volcanic districts, however, the puzzolana formed with lime real hydraulic cement. Neither Vitruvius, Pliny, nor any other writer seems to have known anything more about hydraulic cement than is indicated in the practice described.

"The cement of the ancient Romans must, therefore, have been inferior to that of the present time. The proportions of the various elements were not fixed, the coefficient of the silicate of alumina varying, without any apparent cause, from one to four parts. We have gone far ahead, says M. Ferrand, of this famed production of antiquity. Dwelling on the immense progress that has been made since the Roman-period in synthetical chemistry, M. Ferrand says the superiority of our cements is not due to the use of any absolutely new material, but to the fact that at the present day these materials are understood and employed in a precise, scientific and judicious manner.

"The hardness of the Roman cement discovered in modern times is attributed to several circumstances. The Romans built their walls of great thickness, and thick walls constructed of materials which are bad conductors of the atmospheric fluids always preserve a latent humidity, more or less sensible according as the distance between the faces of the wall is more or less great. It is well known that the temperature of a block of building, in consequence of the inconductivity of its elements, varies but little. Here we have the secret of the hardness of old Roman cement or mortar; it is a hydrate of lime, and thus, instead of being destroyed by humidity, as plaster or common lime would be, it benefits by it just as aquatic plants thrive on water; moreover, a uniform temperature is peculiarly suited to its preservation. The scrupulous care which the Romans took in the selection of their materials is a grand element in the duration of their constructions. Stone was not employed until it had been exposed to the effects of the air for two years, and if, at the end of that time, it did not appear sound, it was broken up and used for filling the foundation walls. When the cement was used for covering surfaces, the Romans were accustomed to lay it on thick, sometimes to the depth of four or five inches, and it is evident that such a solid coating would last much longer than a thinner one, and have a great effect on the preservation of the walls themselves.

"The very careful manner in which the Roman mortars and cements were made was another cause of their hardness and durabillty. This probably arose out of the gigantic nature of their constructions, and the demands of a luxurious people, revelling in wealth, and knowing no limits to their enjoyments.

"Another cause still, was the enployment of artificial means, at great cost, to harden the surface of their coating of cement; one of the substances used for this end is described by Pliny; it was called 'maltha,' and consisted of quicklime slaked in wine, and then ground up in figs and lard; this made the surface upon which the mixture was spread, after an application of oil, harder than stone. If maltha was used to indurate the surface of the great tanks and conduits of old Rome, that people must have dared expenses which, even with the aid of slave labor, throw all of our material extravagance into the shade. Vitruvius, also, recommends that all cement should, before the approach of winter, be dressed with waste oil, in order to protect it from the action of frost; and he says, further, that lime slaked in oil makes excellent mortar. The action of the maltha is thus explained; the bitartrate of potassa and tartrate of lime in the wine played the same part as potash in the manufacture of soap from oil; the grease, mixed with the tartar, became insoluble in lime; the tartrate of iron, sulphate of potassa, and phosphate of alumina in the wine favored this mixture; the stearine and oleine uniting, like the grease, with the lime under the influence of the tartar, made the mixture more unctuous As to the figs, they contain about 62 per cent. of uncrystallizable sugar, 5 per cent. of gum and phosphate, 15 per cent. of fibrine and grease, the rest being water and chloride of lime; they were probably boiled in the wine before mixture with the lard. The sugar must have been the chief agent, preventing the decomposition of the lard and wine, and, not being crystallizable, it retained its initial qualities; the maltha thus formed an impermeable dressing, which shut out the destructive elements of the air or water. The Romans also used a bituminous dressing composed of pitch and slaked in wine. The discovery of the formation of artificial stone by plunging cubes formed of sand and clay into chloride of calcium, is pronounced to be the most important, only waiting for the economic production of the chloride. The hydraulic qualities of marine calk, and silicate of alumina when treated with alkalies, has led to the production of a new kind of cement of great value.

"We all know how enthusiastic some are in their praises of ancient structures which have resisted for ages the ravages of time, and think themselves at liberty to draw conclusions which are not favorable to the architecture of the present time. Although they may be in a measure correct, it cannot be denied that such critics are too partial in their admiration for things ancient as opposed to things modern. Vitruvius, the architect of Augustus, the only author of note who has left us anything in the shape of a work on architecture, has said nothing that entitles the architects of antiquity to be placed above those of the present time."

The ancient masons were so very scrupulous in the process of mixing their mortar that it is said the Greeks kept ten men constantly employed for a long space of time to each basin; this rendered their mortar of such prodigious hardness that, Vitruvius tells us, the pieces of plaster falling off from old walls served to make tables.

It was a maxim among the old masons to their laborers that they should dilute the mortar with the sweat of their brows; that is, labor a long time, instead of drowning it with water to have it done the sooner.

The weakness of modern mortar compared to the ancient, is a common subject of regret; but many ingenious men take it for granted that the process used by the Roman architects in preparing their mortar is one of those arts which are now lost, and have employed themselves in making experiments for its recovery.

But the characteristic of all modern artists, builders among the rest, seems to be to spare their time and labor as much as possible, and to increase the quantity of the article they produce without much regard to goodness; and perhaps there is no manufacture in which it is so remarkably exemplified as in the preparation of common mortar.

Portland Cement.—The age test of durability is one hardly of a speculative character. The extent of the Portland cement experience of prominent men, such as Gillmore, covers a space of a quarter of a century, and considering the difficulties surrounding its introduction and first manufacture, it is surprising to what perfection it has already attained. Iron, brick, stone and timber suffer, more or less, from atmospheric and climatical action. Iron, unless constantly coated with metallic paint, becomes oxydized to an injurious, and even dangerous extent. Bricks, as they may be hard or soft, deteriorate in a prejudicial degree. Stone, unless of the best selected varieties, but too significantly point out and caution us against its indiscriminate use. Timber, when even subjected to any of the numerous preparations for the arrest of decay, is too untrustworthy a material for general use, and can and should only be used where unavoidable. In all the above materials, the maximum amount of their constructive value is obtained at first, and no subsequent improvement is ever or can possibly be realized. On the other hand, Portland cement does not reach its greatest strength until years after it has been used; indeed, our knowledge is still imperfect as to the ultimate range of improvement it may attain. Iron requires protoxide paints; bricks and stone must be subjected to indurating solutions; and timber must be protected from decay by some chemical preservative, more remarkable for its promise than its performance. No preparation, on the other hand, is required for Portland cement; indeed, any coating of paint excluding the air would act prejudicially, and retard the progressive crystallization or the *setting* process. In the air, in the water, and, in fact, under all imaginable circumstances, the possibility of using this material with success forms one of the greatest recommendations in its favor. There has already been some advance in this direction; but a combination of this kind should only be attempted where the cement can be obtained of an undeniably excellent quality and strength. No free, unslaked lime should be present, or injurious action will arise and cause disappointments.

S. L. Merchant & Co., 5 Bowling Green, N. Y., are agents for this cement in the United States.

Concrete House.—The following instructions for building a concrete house will, doubtless, be found useful to many plasterers; it is by a person who has recently completed one in a like manner:

1. Select, if possible, a dry situation, and get all heavy materials,

such as rock, sand, lime, gravel, etc., on the spot as early in the season as possible, say by the first or middle of May, in order that you may avail yourself of the long, warm days of summer for successfully carrying on your operations.

2. The proper materials are lime, sand, coarse and fine gravel, large and small rock, and water. The lime may be from any good, pure limestone, that will slake readily and "set" or harden thoroughly when dry; the sand should be sharp, and as clear from clay, loam and other earthy matter as possible, and the gravel and rock may be of any size from that of a boy's marble to eighteen inches or two feet square, according to the thickness of your walls.

3. Having fixed on your plan, lay off the foundation, and dig a trench two feet deep, the area of full size of your cellar wall. With a heavy piece of hard wood, squared or rounded at the lower end, pound or ram down the earth in the bottom of the trench, going over it repeatedly until it is solid and compact. A layer of hydraulic cement-mortar, two inches thick, spread evenly over the bottom of the trenches thus compacted gives you a solid foundation to start on as soon as it "sets" or becomes hard. If you intend carrying up inside division walls of concrete the foundation for these should be laid in the same way. Good hydraulic cement will take at least three parts of sharp sand, but it must be used as soon as mixed or it will "set" and become useless.

4. Cut common 3 by 4 inch scantling two feet longer than you wish your highest story to be; set up a double row, with the lower end resting firmly on the edge of the hardened cement in the bottom of the trench; range them true and "plumb" them, letting them stand three or four inches further apart than you desire your wall to be in thickness; then nail cleats across above and below, to keep them in place, adding also "stays" or "braces," driven slantingly at the upper end. Your skeleton or framework of scantling being all set up and "stayed" firm and "plumb," proceed to arrange your "boxing" for holding the concrete and keeping the walls in shape. This is done by cutting sound inch or inch-and-a-half plank of ten inches or a foot wide so as to fit inside of the two rows of scantling and form two sides of the box. Mov-

able pieces, the thickness of the wall are dropped in between at intervals, to keep the box of the proper width, and wedges driven in between the boxing and scantling, on the outside, prevent spreading by the pressure of the concrete. Wooden "clamps," to slip down here and there over the upper edges of the boxing, will also be found very serviceable.

5. It will be well to have at least four large mortar beds—one on each side of the house, made of strong planks in the usual way. These should be surrounded by casks of water (oil casks cut in two are excellent), piles of rocks, sand, gravel, etc.—the lime, of course, to be kept under cover, and used as wanted. Slake up your lime till it forms a thin, smooth, creamy mass; add four or five parts of sharp sand, stirring and mixing constantly, and using water enough to bring the whole, when thoroughly mingled, to the consistency of a thick batter. Into this batter mix coarse and fine gravel (that has previously been screened) until the mass is thick enough to be lifted on a common shovel. (The proper and thorough mixing of the sand with the lime, and the gravel with the mortar afterward, are very important, and should only be intrusted to your most careful hands.) Having one or two "beds" full of this mixture, you are ready to begin your wall: Wheel the mortar to the foundation in common railroad wheelbarrows, letting the common hands shovel it into the bottom of the trenches, while the superintendent or "boss" workman spreads it evenly with his trowel. When the bottom layer of mortar, three inches thick, is laid in, wheel large and small rock (previously sprinkled with water) to the wall and press it into the soft mortar at every available point, leaving a small space between each piece of rock, and working the soft mortar against the plank boxing, to preserve a smooth surface on the wall. When you can press no more rock into the mortar, pour another layer of the latter over and through the rock, then add a layer of rock, as before, and so on, until your boxing all round is full. You have now ten inches or a foot of wall all round built; and if the lime is good and weather dry it will be hard enough in twenty-four hours to raise your boxes another tier. This is readily done by knocking out the wedges between the plank and the scant-

ling, raising up the plank and sustaining it in place by "cleats" nailed on the scantling. In raising the boxing, begin at the point where you commenced laying up the day previous, as that portion of the wall will, of course, be the hardest. It is not necessary to raise all the boxing at once, or go entirely around the wall in a day. A foot or yard of the wall can be completed at a time, if advisable; but if the complete round can be made, so much the better. Planks to cover up with, in case of a sudden shower or when a storm is apprehended, should be provided and placed within reach.

6. We prefer a cement floor for the basement on many accounts, but those who desire a wooden floor should leave air-holes in the outer wall under the lower floor, six inches above the surface. This may be easily done by inserting wedge-shaped blocks or pins through the wall, to be knocked out afterward. When you are ready to lay the floors, level up your wall and run one course of brick all around the thickness of the wall, for the ends of the flooring joists to rest on, filling-in around these ends with concrete when they are fixed in their proper places. The door and window-frames should be made of three-inch yellow-pine, the thickness or width of the walls, and may be set up and built around, like those in a brick house, as the walls progress. A piece of common inch-plank, "cut in" all around them, to prevent the actual contact of the damp mortar, will keep them, in a great measure, from warping. Where base-boards are needed, blocks of scantling may be built in flush with the inner surface of the wall, at the proper distance apart.

Comparative Strength of Different Mortars and Cements in Brick Piers.—Mr. F. E. Kidder, C.E., who has made many experiments on building materials, constructed seven brick piers, 8 × 12 feet, each pier laid in a different mortar, and after about five months' space of time, during which time they were allowed to harden, the piers were all tested under compression until they were crushed.

The strength per square inch of the brick [illegible] in the experiments was 12,186 lbs.

The strength per square inch of;

Pier laid in	common lime mortar....................	1,562 lbs.
" "	Lime mortar, 3 parts. Portland cement, 1 part.................	3,020 "
" "	Lime mortar, 3 parts. Newark and Rosendale cements, 1 part...	2,552 "
" "	Lime mortar, 3 parts. Roman cement, 1 part..................	2,030 "
" "	Portland cement, 1 part; sand, 2 parts...	2,500 "
" "	Newark and Rosendale cements, 1 part; sand, 2 parts..........................	2,135 "
" "	Roman cement, 1 part; sand, 2 parts...	1,927 "

The last pier sustained a greater pressure before breaking than any pier except the second, but it failed rapidly after it commenced to crack.

From these figures we see that the strength of a pier is not so much in the brick as in the mortar in which they are laid; hence the most care should be given to the mortar in piers intended to carry great loads.

The piers on an average commenced to crack under about half their breaking strength.

◆

FORM OF AGREEMENT

For Plastering and Stucco Work.

Articles of Agreement, Made and entered into this..............day of ....in the year One Thousand Eight Hundred and.............., By and Between...

....

of the..........of...................., County of...................., and State of.................., as the part........of the First Part, and ...., of the................of................, County of.................. , and State of.................., as the part..........of the Second Part.

Witnesseth: First.—The said part......of the second part do...... hereby, for.................. .....heirs, executors, administrators or assigns, covenant, promise and agree to and with the said part......of the first part, ...heirs, executors, administrators or assigns, that ....the said part........of the second part,..........heirs executors, administrators or assigns, shall and will, for the consideration hereinafter mentioned, on or before the..............day of................, in the year One Thousand Eight Hundred and................., well and sufficiently finish, in a true, perfect and thoroughly workmanlike manner, the...

....

for the part........of the first part, on ground situated..................

...., in the............

of.............., County of..................., and State of............, agreeably to the specifications prepared for the said works by............

..........................., Architect , to the satisfaction and under the direction and personal supervision of..................................

Architect , and will find and provide such good, proper and sufficient materials, of all kinds whatsoever, as shall be proper and sufficient for the completing and finishing all the.....................................

...............................and other works of the said building mentioned in the.............,specifications, and signed by the said parties, within the time aforesaid, for the sum of........................

..................................Dollars.

Second.—The said part......of the first part do....hereby for.......... heirs, executors, administrators or assigns, covenant, promise and agree to and with the said part......of the second part, ...heirs, executors, administrators, or assigns, that........the said part......of the first part,........heirs, executors, administrators or assigns, will and shall in consideration of the covenants and agreements being strictly executed, kept and performed by the said part......of the second part as specified, will well and truly pay, or cause to be paid, unto the part...... of the second part, or unto.........heirs, executors, administrators or assigns, the sum of...

Dollars, lawful money of the United States of America, in manner following :

First payment of $...

....

Second payment of $..

....

Third payment of $...

....

Fourth payment of $..

....

Fifth payment of $..

....

....

when the work is all complete, and after the expiration of...........days.

PROVIDED, that in each case of the said payments a certificate shall be obtained from and signed by.............................., Architect, to the effect that the work is done in strict accordance with drawings and specifications, and that he considers the payment properly due; said certificate, however, in no way lessening the total and final responsibility of the part......of the second part; and, *Provided further*, that in each case a certificate shall be obtained by the part......of the second part, from the clerk of the office where liens are recorded, and signed and sealed by said clerk, that he has carefully examined the records and finds no liens or claims recorded against said works, or on account of the said part..... of the second part.

AND IT IS HEREBY FURTHER AGREED, BY AND BETWEEN THE SAID PARTIES:

Third.—The Contractor, at his own proper costs and charges, is to provide all manner of labor, materials, apparatus, scaffolding, utensils and cartage of every description needful for the due performance of the several works; and render all due and sufficient facilities for the inspection of the work and materials.

Fourth.—Should the Owner, at any time during the progress of the said works, require any alterations or deviations from, additions to, or omissions in the said Contract, he shall have the right and power to make such change or changes, and the same shall in no way injuriously affect or make void the Contract; but the difference shall be added to or deducted from the amount of the Contract, as the case may be, by a fair and reasonable valuation.

Fifth.—No work shall be considered as extra, unless a separate estimate, in writing, for the same, shall have been submitted by the Contractor to the Owner, and his signature obtained thereto.

Sixth.—The owner will not, in any manner, be answerable or accountable for any loss or damage that shall or may happen to the said works, or any part or parts thereof respectively, or for any of the materials or other things used and employed in finishing and completing the said works.

Seventh.—Should the Contractor fail to finish the work at or before the time agreed upon, ...shall pay to the part......of the first part, the sum of...dollars per diem, for each and every day thereafter the said works shall remain unfinished, as and for liquidated damages.

Eighth.—

....

....

....

....

In Witness Whereof, The said parties to these presents have hereunto set their hands and seals, the day and year above written.

Part......of the First Part, { ....
{ ....

Witnesses, { ....
{ ....

Part......of the Second Part, { ....
{ ....

Witnesses, { ....
{ ....

GLOSSARY OF TERMS

USED

IN PLASTERING AND PLASTER DECORATION.

Abaci.—Supposed by Vitruvius to mean panels in the stucco of walls, and used as a decoration above the dado.

Abreuvoir.—The joint between two stones, or the interstices left to be filled up with mortar or cement.

Admeasurement.—Adjustment of proportion; technically an estimate of the quantity of materials and labor of any kind used in building.

Albarium Opus. (*Lat.*)—A sort of plastering composed of pure lime; used by the ancients for incrusting laths and making cornices.

Alto-relievo.—High relief. A sculpture, the figures of which project from the surfaces on which they are carved.

Angle-Bead.—Vertical beads, generally of wood, fixed to exterior angles, flush with the intended surface of the plaster, on both sides, for the purpose of fortifying the angles against accident; they serve also for floating the plaster. Their section is about three-fourths of a circle, with a projecting part from the other quarter, by which they are fastened to the corner stud, wood bricks, plugging, or bond timbers. The section of angle-bead is sometimes that of a triple-bead, the middle one being larger than the two outer ones, and flush with the plaster. Angle-beads of wood around the intradosses of circular arches are difficult to bend without cutting or steaming them; the former has an unsightly appearance, and the latter is inconvenient and troublesome; for this situation of angle-beads, no other material will finish as well as the plaster itself, and it will be sufficiently strong, as at that height it is more out of the reach of accident. Whenever wooden and plaster beads are employed in the same margin or angle, they should never join each other, but should always have an impost to intervene, as otherwise the joint will show. In better-class finishing, no corner-beads are employed; but the plaster is well gauged, and brought to an arris.—NICHOLSON.

Angle-Float.—A *float* made to fit any internal angle of the walls of a room. A *float* is a plasterer's trowel.—KNIGHT.

Angle-Staff.—A strip of wood fixed to the vertical angle of a wall flush with the plastering of the two planes. It is designed as a substitute for plastering in a situation so much exposed. A *round* staff is known as an *angle-bead*.—KNIGHT.

Arabesque.—The term is commonly used to denote that sort of ornament in Saracenic architecture, consisting of intricate rectilinear and curvilinear compartments and mosaics which adorn the walls, pavements and ceilings of Arabian and Saracenic buildings. It is capricious, fantastic and imaginative, consisting of fruits, flowers and other objects, to the exclusion, in pure Arabesques, of the figures of animals, which the religion forbade. This sort of ornament, however, did not originate with the Arabians; it was understood and practiced by the ancients at a very early period. Foliage and griffins, with ornaments not very dissimilar to those of the Arabians, were frequently employed on the friezes of the temples, and on many of the ancient Greek vases, on the walls of the baths of Titus, at Pompeii, and at many other places. To Raffaele, in modern times, we are indebted for the most elaborate and beautiful examples of a style of decoration called Arabesque, which he even dignified, and left nothing to be desired in it. Since the time of that master it has been practiced with varying and inferior degrees of merit, especially by the French in the time of Louis XVI. Arabesques lose their character when applied to large objects; neither should they be employed where gravity in style is to be preserved.—GWILT.

Walls of concert rooms, theatres and casinos are sometimes finished in this style, the ornamentation being in plaster, *papier maché*, or other suitable materials.

Architrave Cornice.—An entablature consisting of an architrave and cornice only, without the interposition of a frieze. It is never used with columns or pilasters, unless through want of height. It is, however, allowable.

Arch.—Sometimes the plasterer may be called upon to run mouldings on the margin of arches; the following will aid him somewhat in his work:

The Semi-circular Arch was that principally used by the Romans, who employed it largely in their aqueducts and triumphal arches. The others are, however, mentioned by some writers as having been occasionally employed by the ancients. During the middle ages other forms were gradually introduced.

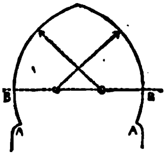


Fig. 1.

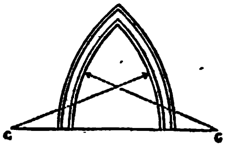


Fig. 2.

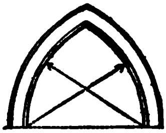


Fig. 3.

The Stilted Arch is an adaptation of the semi-circular arch, in which the springing line is raised above the top of the column, on a pedestal not much larger in diameter than the width of the voussoirs of the arch.

The Horse-shoe Arch.—This is almost restricted to the Arabian or Moorish style of architecture. In this form of arch the curve is carried below the line of centre or centres; for in some cases the arch is struck from one centre, and in others from two, as in Fig. 1.

Now it must not be supposed that the real bearing of the arch is at the impost A A; for if this were really so, it must be seen that any weight or pressure on the crown of the arch would cause it to break at B, but the fact is simply that the *real* bearings of the arch *are* at B B, and the prolongation of the arch beyond these points is merely a matter of form, and has no structural significancy. The Horse-shoe arch belongs especially to the Mohammedan architecture, from its having originated with that faith, and from its having been used exclusively by its followers.

Next in point of time, but by far the most graceful in form, is the *pointed arch*, which is essentially the mediæval (or middle age) style, and is capable of almost endless variety. The origin of this form of arch has been the subject of much antiquarian discussion; but it is certain that although the pointed arch was first generally used in the architecture of the middle ages, recent discoveries have shown that it was used many centuries previously in Assyria.

The greater or less acuteness of the pointed arch depends on the position of the centres from which the flanks are struck.

The Lancet Arch.—This arch, Fig. 2, is constructed by placing the centres O O outside the span, but still on the same line with the imposts. This form of arch was first used in the Gothic, and as a rule indicates the style called "Early English."

Equilateral Arch.—Fig. 3 shows the Equilateral arch, the radius with which the arcs are struck being equal to the span of the arch, and the centres being the imposts; and thus, the crown and the imposts being united, an equilateral triangle is formed. This form was principally used in the "Decorated" period of Gothic architecture from about 1307 until about 1390, at which time the *Ogee* arch (Fig. 4) was also occasionally used.

At a later date, during the existence of the "Perpendicular" style of Gothic architecture, viz., from the close of the 14th century to about 1630, we find various forms of arch introduced, such as the *Segmental* (Fig. 5), formed of segments of two circles, the centres of which are placed below the springing; and still later on we find the *Tudor*, or four-centred arch (Fig. 6), in which two of the centres are on the springing and two below it. The arches at the later period of this style became flatter and flatter, and this forms one of the features of Debased Gothic, when the beautiful and graceful forms of that style gradually decayed, and for a time were lost. Happily, in the present century there has been a gradual and spirited revival of the Gothic style, and works are now being produced which bid fair to rival in beauty of form and in principles of construction the marvellous buildings of the middle ages.

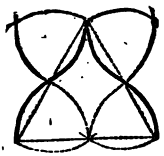


Fig. 4.

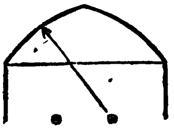


Fig. 5.

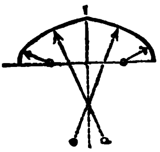


Fig. 6.

From the examples given, the workman will be able to lay out any of the usual arches required in plastering.

Asphalte.—A bituminous substance found in various places. It is frequently used for floors and roadways; it is either poured on in a liquid state, forming, when set, a hard substance, impervious to damp, or it is placed on the ground in powder, in a hot state, and pressed down by hot iron rammers. Some of the best walks in Central Park, New York City, are formed of this material.

Atkinson's Cement.—A quick-setting cement, similar to Parker's or Roman cement, formerly obtained from nodules found near Whitby, in Yorkshire, England.

Attributes—In decorative architecture, are certain symbols given to figures, or disposed as ornaments on a building, to indicate a distinguishing character; as a lyre, bow, or arrow to Apollo; a club to Hercules; a trident to Neptune; a spear to Pallas, etc.; for attributes given to saints and others in mediæval architecture. See "Architectural Symbols," published by Andrews & Co., Chicago, Ill.

Badigeon.—A mixture of plaster and freestone sifted and ground together, used by statuaries to repair defects in their work. The joiner applies this term to a mixture of sawdust and strong glue, with which to fill up the defects of the wood after it has been wrought. A mixture for the same purpose is made of whiting and glue, and sometimes with putty and chalk. When the first of these is applied it is allowed to remain until quite hard, after which it may be submitted to the operation of planing and smoothing. Without this precaution it may sink below the surface of the work.– GWILT.

Base of a Room.—The lower projecting part. It consists of two parts, the lower of which is a plain board adjoining the floor, called the plinth, and the upper part of one or more mouldings, which, taken collectively, are called the base-mouldings. In better sort of work the plinth is tongued into a groove in the floor, by which means the diminution of breadth created by the shrinking never causes any aperture or chasm between its under edge and the floor, and the upper edge of the plinth is rebated upon the base. Bedrooms, lobbies, passages and staircases are often finished without a dado and surbase, and indeed the fashion has extended the practice to rooms of the higher class, as drawing-rooms, etc.—GWILT.

Bastard-Stucco.—The finishing coat of plaster when prepared for paint.—KNIGHT.

Basso-Relievo or Bass-Relief.—The representations of figures projected from a background without being detached from it. It is divided into three parts, *alto-relievo*, when the figure projects more than one-half, *mezzo-relievo*, that in which the figure projects one-half; and *basso-relievo*, when the projection of the figures is less than one-half, as in coins.

Battening.—The fixing of battens to walls for the reception of laths on which the plaster is to be laid. It also signifies the battens in the state of being fixed for that purpose. The battens employed are usually about two inches broad and three-fourths of an inch thick; the thickness, however, may be varied according to the distances that the several fixed points are from each other. Their distance in the clear is from eleven inches to one foot. To fix battens, equidistant bond timbers were formerly built in the wall; the wall is now plugged at equal distances, and the plugs cut off flush with its surface, or the battens are spiked into the walls. The plugs are generally placed twelve or fourteen inches from centre to centre in the length of the batten. Battens upon external walls, the ceiling bridging joists of a naked floor, also the common joists for supporting the boarding of a floor, are fixed at the same distance, viz., from eleven to twelve inches in the clear. When battens are fixed against flues, iron holdfasts are of course employed instead of bond timbers or plugs. When they are attached to a wall they are generally fixed in vertical lines, and when fixed to the surface of a stone or brick vault, whose intrados is generated by a plane revolving about an axis, they ought to be placed in planes tending to the axis; as in this position they have only to be fixed in straight lines, in case the intrados is straight towards the axis, which will be the case when it is a portion of a cone or cylinder; and when the intrados is curved toward the axis they will bend the easiest possible. Great care should be taken to regulate the fans of the battens, so as to be as nearly as possible equidistant from the intended surface of the plaster. Every piece of masonry or brickwork, if not thoroughly dry, should be battened for lath and plaster, particularly if executed in a wet season. When windows are boarded, and the walls of the room not sufficiently thick to contain the shutters, the surface of the plastering is brought out so as to give the architrave a proper projection, and quarterings are used for supporting the lath and plaster in lieu of battens. This is also practiced when a breast of a chimney projects into a room in order to cover the recesses and make the whole side flush, or all in the same surface with the breast.—GWILT. [In America the term "Batten" is seldom used in connection with wall strips; such strips are called "Furrings."]

Bitumen.—A mineral pitch used in former ages instead of mortar. The bricks of the walls of Babylon are said to have been cemented together with it.

Black Mortar.—This is made by mixing finely-powdered anthracite (hard coal) coal dust with the lime, instead of sand.

Boarding for Pugging or Deafening, ALSO CALLED SOUND BOARDING.—Short boards disposed transversely between the joists of floors to hold some substance intended to prevent sound. These boards are supported by *fillets* fixed to the sides of joists, about three-quarters of an inch thick and an inch wide. The substance, often plaster, placed between them to prevent the transmission of the sound, is called the pugging.

Boss.—A short trough for holding mortar. Hung from the laths and used in tiling a roof.

Bracketing to a Cornice.—The wooden ribs nailed to the ceiling joists, and battening for supporting the cornices of rooms when too large for security, by a mere dependance on the adhesive power of plaster to the ceiling. It consists of vertical ribs whose rough outline is that of the cornice, and to which the laths are nailed for sustaining the plaster in which the mouldings are run. The bracketing for coves is only an enlargement of the scale which occurs in ordinary cornices, the operation being of obtaining a set of ribs to which the laths may be nailed for the reception of the plastering; the ribs in question are usually cut out of planks, whose thickness must necessarily vary with the weight of plaster they have to support.—GWILT.

Byzantine Architecture.—A style developed in the Byzantine Empire. The capitals of the pillars are of endless variety and full of invention;

some are founded on the Greek Corinthian, some resemble the Norman and Lombard style, and so varied that no two sides of the same capital are alike. They are comprised under the style Romanesque, which comprehends the round arch style.

Camp Ceiling.—A ceiling whose form is convex inwardly.

Carcass.—The naked building of a house before it is lathed and plastered, or the floor boards laid, etc.

Caissons.—Sunk panels in ceilings or in soffits.

Carton, or Cartoon.—A design made on strong paper, to be transferred on the fresh plaster wall to be afterwards painted in fresco; also a colored design for working in Mosaic tapestry, etc.

Cartouche..—An ornament resembling a scroll of paper, being usually in form of a table, or flat member, with wavings, bearing some inscription or device. It is nearly akin to a modillion with this exception, that the cartouche is used only externally, whilst the modillion is used both internally and externally, as under the cornice in the eaves of a house.

Cement. (*Lat. Cementum*).—The medium through which stones, bricks or any other materials are made to adhere to each other.—*See Mortar.*

Centre. (*Lat. Centrum*).—In a general sense denotes a point equally remote from the extremes of a line, superfices, or body, or it is the middle of a line or plane by which a figure or body is divided into two equal parts; or the middle point is dividing a line, plane or solid, that some certain effects are equal on all its sides. For example, in a circle the centre is everywhere at equal distance from the circumference; in a sphere the centre is a point at the same distance from every point in the surface.

Chimney. (*Fr. Cheminee*).—The place in a room where a fire is burnt, and from which the smoke is carried away by means of a conduit called a funnel or a flue. Where the walls are sufficiently thick, the chimneys are formed in the substance of them, but they are usually made by a projection from a wall and a recess in the same from the floor, ascending within the limits of the projection and the recess. The part of the opening which faces the room is properly called the *fireplace*, the stone, marble, or metal under which is called the *hearth.* That on a level with and in front of it is the *slab*, though often called the hearth. The vertical sides of the opening are called *jambs* The head of the fore-plate resting on the jambs is called the *mantel.* The tube or cavity from the fireplace upwards is called the *funnel* or *flue.* The part of the funnel which contracts as it ascends is termed the *gathering*, by some the *gathering of the wings.* The part between the gathering and the flue is called the *throat.* The part of the wall facing the room, and forming one side of the funnel parallel thereto, or the part of the wall forming the sides of the funnels where there are more than one, is the *breast.* In external walls, that side of the funnel opposite the breast is called the *back.* When there is more than one chimney in the same breast, the solid parts that divide them are called *withs* or *withes*; and when several chimneys are collected into one mass it is called a *stack of chimneys.* The part which rises above the roof, for discharging the smoke into the air, is called a *chimney shaft*, whose horizontal upper surface is termed the *chimney top;* on this is placed the *chimney pot*, or contrivance for dissipating the smoke, or for creating a draught. The coverings were formerly placed at right angles to the face of the wall, and the chimney was finished in that manner; but Count Rumford showed that more heat is obtained from the fire by reflection when the coverings are placed in an oblique position. He likewise directed that the fire itself should be kept as near to the hearth as possible, and that the throat of the chimney should be constructed much narrower than had been practiced, with a view of preventing so much heated air as happened with wide throats. If the throat be too near the fire, the draught will be too strong, and the fuel will be wasted; if it be too high up, the draught will be too languid, and there will be danger of the smoke being occasionally beaten back into the room. The chimney of large furnaces and for boilers is called a *stalk*, and built very tall in order to create sufficient draught for the fire.—Gwilt.

Cistern.—A reservoir for water, whether sunk below or formed of planks of wood above ground. In the construction of an earthen cistern, a well-tempered stratum of clay must be laid as a foundation for a brick flooring, and the bricks laid in terras mortar or Parker's cement. The sides must be built with the same materials; and if in a cellar or other place near a wall a space must be filled with clay, from the foundation to the top of the cistern contiguous to the wall by which means it will be preserved from injury. Cisterns above ground are usually formed of wooden planks lined with lead or zinc, and carried by bearers; but the cistern formed of slates, now much used, is the best for adoption.

Coarse Stuff.—The first coat of inside plaster work. It is composed of common lime mortar, as made for brick masonry, with a small quantity of hair; or by volumes, lime paste, 1 part; sand, 2 to 2¼ parts; hair, ⅙ part.—Knight.

Coat.—A layer of plastering.

A Scratch Coat is the first of three coats; when laid upon laths it is from ¼ to ⅜ of an inch in thickness.

One-Coat Work is plastering in one coat without finish, either on masonry or laths—that is, rendered or laid.

Two-Coat Work is plastering in two coats, done either in a *laying coat* and *set*, or in a *screed-coat* and *set*.

Screed Coat.—A coat set even with the edges of the screeds.

Floated Coat.—A first coat, laid on with a float.

Slipped Coat is the smoothing off of a brown coat with a small quantity of lime putty, mixed with 3 per cent. of white sand, so as to make a comparatively even surface.—Knight.

Concrete. (Lat. *Concrescere*).—To coalesce in one mass. A mass composed of stone chippings, or ballast, cemented together through the medium of sand and lime, or of cement, and usually employed in making foundations where the soil is of itself too light or boggy, or otherwise insufficient for the reception of the walls. It is likewise used to cover the ground under a building to keep damp from rising. Also to form a backing to a wharf wall. or one at the side of a railway cutting, for extra strength. Of late years it has been used in lieu of bricks or stone wherewith to build incombustible houses; and a church has been built of it near Paris. Large concrete blocks are used for the interior work of piers to harbors, and similar extensive erections.—Gwilt.

Cornice. (Fr. *Corniche*).—Any moulded projection which crowns or finishes the part to which it is affixed; as the cornice of an order, of a pedestal, of a pier, door, window, house, etc. The cornice of an order is a secondary member of the order itself, being the upper subdivision of the entablature.

Cylindric Ceiling.—A ceiling vaulted in the shape of a segment of a cylinder. Cylindrical ceilings admit of being pierced by lunettes, which form cylindro-cylindric arches. They should be decorated with coffers, separated by soffits and enriched with guilloches.

Cyma.—A moulding with an undulating or waved profile, partly convex and partly concave, called by workmen an ogee. When the hollow part is uppermost, it is called a cyma-recta; when the convex part is above, a cyma-reversa; when it is the upper moulding of a cornice it is called cymatium.

Cymatium.—The upper moulding of a cornice of three kinds of cymatia, the *Tuscan* is supposed to have been an ovolo, or quarter round; the Doric an ovolo or cavetto, and the *Lespian* the cyma inversa.

Dado.—The die, or that part of the pedestal of a column between the base and the cornice. It is of a cubic form, whence the name of die. Large rooms are sometimes decorated with a base, dado, and cornice, representing a pedestal, and the term dado is often applied to the whole.

Dampness.—A moisture generally attendant on buildings finished hastily on account of the materials not being dry; or the walls not being made of good well-burnt bricks; or with bad mortar; or the joints not flushed up, and allowing wet to come through.

DARBY.

Darby.—A float-tool used by plasterers in working on ceilings especially. It is 3½ feet long and 7 inches wide, with two handles on the back, by which it is manipulated.—KNIGHT.

Distemper.—(From the French, *Détremper*, to temper or dilute) in painting, the working up of colors with something besides mere water or oil. If colors be prepared with water, the painting is called *liming;* and if with oil, it is called *painting in oil*, or simply painting.

If the colors be mixed with size, whites of eggs, or any such proper glutinous or unctious substance, and not with oil, they then say it is done in *distemper;* as those of the admirable cartoons formerly at Hampton Court, and as all ancient pictures are said to have been before the year 1410.

In distemper, the white color or base generally used is the finest whiting, which is prepared in large quantities by various manufacturers. The colors most commonly mixed with it for producing the various tints are as follows: Straw color may be made with white and masticat, or Dutch pink; fine grays with white and refiner's verditer: an inferior gray may be compounded with blue black or bone black, and damp blue or indigo; pea-greens with French green, Olympian green; and fawn color with burnt sienna; or burnt umber and white, and so of any intermediate tint. All the colors used in distemper should either be ground very fine, or washed over so as to ensure the most minute divisions of their particles, In general, the size made of common glue is used with a proper quantity of water to render the color liquid; but where the work will afford it, parchment-size will be found greatly superior.

It will require not less than two coats of any of the foregoing colors, in order to cover the plaster, and bear out with an uniform appearance. When old plastering has become discolored by stains, and it is desired to have it painted in distemper, it is advisable to give the old plaster, when properly cleaned off and prepared, one coat at least of white lead ground in oil, and used with spirits of turpentine, which will generally cover all old stains, and when quite dry will take the water-colors very kindly.

The best methods of compounding the colors with the vehicles, is to mix the size in water, then to levigate the colors in part of it, and afterwards to put each kind into a proper pot, adding as much more of the wetted size as will bring it to a due consistence, and mixing the whole well together in the pot with a brush or wooden spatula. Warm water may be afterwards added, if necessary, for grinding the colors, or for working. The pots must be covered with bladders and tied. This method of painting is chiefly confined to scenes and grosser works, where the effect depends more upon the perspective and apposition of the colors than upon their brightness.—NICHOLSON.

Dots.—Nails driven into a wall to a certain depth, so that their protruding heads form a gauge of depth in laying on a coat of plaster.—KNIGHT.

Dubbing Out.—Filling up with coarse stuff, tiles, slates, lath or other materials irregularities in the face of a wall previous to finishing it with finer plaster.

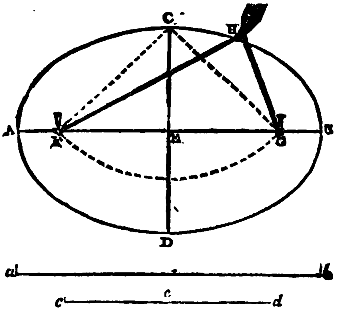
Edifice. (Lat. *Edificium*).—A word synonymous with fabric, building, erection; the word is, however, more usually employed to denote architectural erections distinguished for grandeur, dignity, and importance.

Elevation. (Lat. *Elevatio*).—A geometrical projection drawn on a plane perpendicular to the horizon.

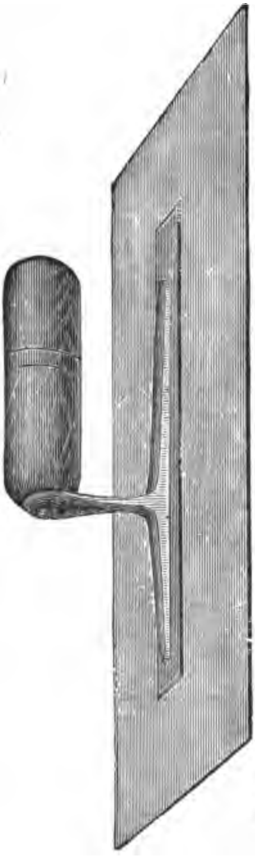
Ellipse or Ellipsis. (Gr. Ελλειψις, defect).—One of the conic sections produced by cutting a cone entirely through the curved surface, neither parallel to the base, nor making a subcontrary section; so that the ellipsis, like the circle, is a curve that returns into itself and completely encloses a space.

This curve may be described by aid of a string as follows:

Let A B be the major axis, and D C the minor axis of the ellipse, and F G its two foci. Take a string E G F and pass it over the pins, and tie the ends together, so that when doubled it may be equal to the distance from the focus F to the end of the axis, B; then putting a pencil in the bight or doubling of the string at H and carrying it round, the curve may be traced. This is based on a well-known property of the ellipse, that the sum of any two lines drawn from the foci to any points in the circumference is the same. (*Also see Trammel*).



Encaustic Work.—An ancient mode of painting, in which the execution was accomplished by the application of heat. It would appear as if one process consisted in mixing the tints in hot wax, which were then applied on the wall; and another, to coat the wall with wax after the tint had been given to the wall, rubbing in well the wax with hot cloths.



PLASTERING TROWEL (MANUFACTURED BY HENRY DISSTON & SONS, PHILADELPHIA, PA.)

Festoon. (Fr.)—A sculptured representation of flowers, drapery and foliage, looped or suspended at intervals on walls. The festoon was much used on friezes, altars, tablets, also over or under niches, as well as in many other situations.

Fine Stuff.—Lump lime slaked to a paste with a moderate volume of water, and afterwards diluted to the consistency of cream, and then left to harden by evaporation to the required consistency for working over floating-coat of coarse-stuff.

In this state it is used for a *slipped-coat*, and when mixed with sand or plaster-of-Paris it is used for the *finishing-coat.*

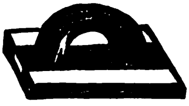
Finishing.—A term frequently applied to the termination of a building; but more especially to the interior in the plasterer's work for the last coat, and often to the joiner's work, as the architraves, bases, surbases, etc.

Finishing-Coat.—The third or last coat of plaster. If for painting, it consists of the best stuff, and is called *stucco.* For papering, it should be as for painting, but is sometimes called *setting coat.*

First Coat.—The primary coat of coarse stuff. That of two-coat work is called *laying*, when executed on lath, and *rendering*, when on brickwork. The first coat of three-coat work is called *pricking-up* on lath, and *roughing-in* on brickwork.

Float.—A plasterer's trowel used in spreading or *floating* the plaster on to a wall or other surface.

The *Long Float* is of such a length as to require two men to use it.



WOODEN FLOAT.

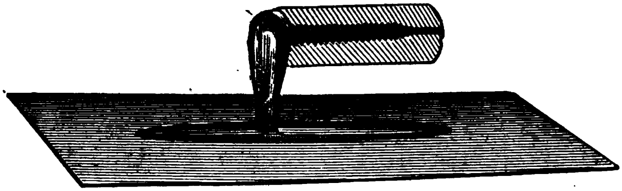
The *Hand-Float* is that in ordinary use.

The *Quick-Float* is used in finishing mouldings.

The *Angle-Float* is shaped to fit the angle formed by the walls of a room.—KNIGHT.

Floated Lath and Plaster.—Plastering of three coats, whereof the first is *pricking-up*, the second floating or floated work, and the last of fine-stuff.

Floated Work.—Plastering rendered perfectly plane by means of a float.



PLASTERING TROWEL (SHOWING HOW MADE).

Floating Screeds.—Strips of plaster previously set out on the work, at convenient intervals, for the *range* of the floating-rule or *float*.

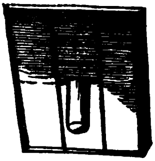
Fresco Painting. (It. *Fresco*, fresh).—A system of wall or ceiling decoration in which a painting is executed by incorporating the colors on the plaster before it is dry, by which it becomes very permanent.

Gauge-Stuff.—A stiff and compact plaster used in making cornices, mouldings, etc. It consists of two-thirds fine mortar, one-third plaster-of-Paris, with a little water added.

Grotesque. (Fr.)—A term applied to capricious ornaments which, as a whole, have no type in nature, consisting of figures, animals, leaves, flowers, fruits, and the like, all connected together.

Grounds.—In joinery, certain pieces of wood attached to a wall, to which the finishings are fastened. Their surface is flush with the plastering. Narrow grounds are those whereto the bases and surbases of rooms are fastened. Grounds are used over apertures, as well for securing the architraves as for strengthening the plaster. That the plaster may be kept firm, should the wood shrink, a groove is sometimes run on the edge of the ground next to the plaster, or the edge of the ground is rebated on the side next to the wall, so that in the act of plastering the stuff is received into the groove or rebate, which prevents it from shifting when it becomes dry. Wide grounds are framed.

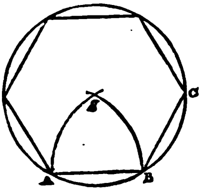
Grout.—A semi-liquid mortar, composed of quicklime and fine sand, poured into the joints of masonry, and those of large masses of brickwork at every four courses or so, in order to fill up the joints well, which process is called *grouting*. It is not required when the joints are properly flushed up.



HAWK.

Hawk.—A small quadrangular tool with a handle, used by a plasterer, on which the stuff required by him is served, for his proceeding with the work in progress. He has always a boy or helper attendant on him, by whom he is supplied with the material. The boy in question is called a *Hawk boy*.

Hexagon.—A six-sided figure. It may be described as follows: Let A B in the figure be a given straight line. From the extremities A and B, as centres, with the radius A B describe arcs cutting each other in *g*. Again from *g*, the point of intersection, with the same radius, describe the circle A B C, which will contain the given side A B six times when applied to its circumference, and will be the hexagon required.



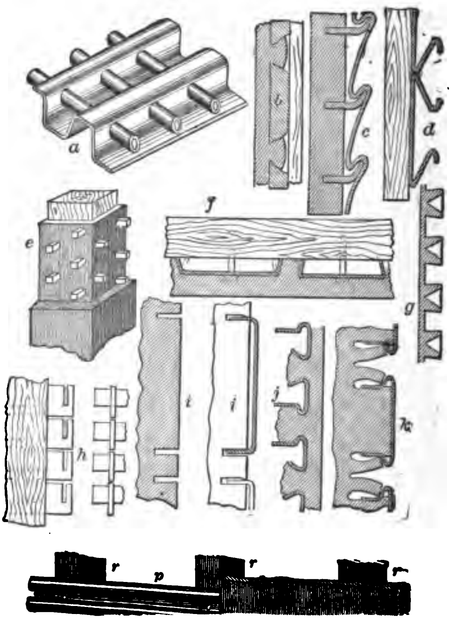
Hick-Joint Pointing.—That species of pointing in which, after the joints are raked out, a portion of superior mortar is inserted between the courses, and made perfectly smooth with the surface.

Interior Angle.—An angle formed with any figure by two straight lined parts of the perimeter or boundary of the figure, the exterior angle being that which is formed in producing a side of the perimeter of the figure. The term is also applied to the two angles formed by two parallel lines, when cut on each side of the intersecting line.

Inverted Arch.—An arch turned with its back and keystone downwards. It is used in foundations, to distribute the weight of particular points over the whole extent of the foundation, and hence its employment is frequently of the first importance in constructive architecture. Such an arch has been used in some of the English cathedrals to form a buttress between the piers of the central tower when they appeared to be giving wayf rom the weight above.

Lath.—One of the narrow strips of wood nailed to the studs of partitions to support the plastering. Strips of metal are sometimes used for this purpose in fire-proof structures. Such lath have means for securing to the studding or wall, and also affording a key to the mortar which is laid thereon.

Slips of wood used in plastering are noticed by Pliny.



IRON LATHING.

Lath Coated and Set Fair.—Three-coated plasterer's work. The first is called "*pricking up,*" the second "*floated,*" the third "*finishing.*"

Lath Laid and Set.—Two-coated plasterer's work. The first is called "*laying,*" the second "*finishing.*"

Metallic lath for wooden or iron partitions has been made in various forms, of which the annexed instances may be given:

a Has a corrugated plate and transverse rods, behind which latter the plaster makes its lock.

b Has plates with dovetail holes, in which the plaster fastens.

c Has corrugated plates which catch upon hooks on the studding.

d Has plates which present bent prongs.

e Has metallic plates with frustrums presenting their bases outwardly.

f Has strips with flanged corrugated edges.

g Has sheets with projecting studs of frustal form.

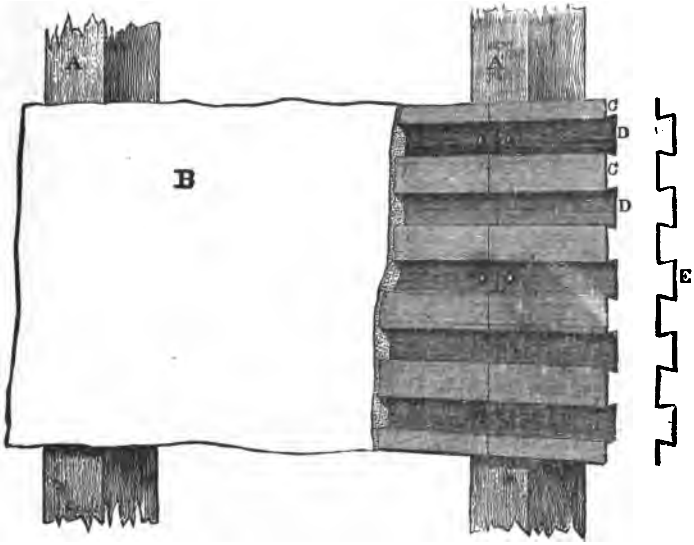
h Has iron slats which are held by slotted iron plates driven into the studding.

i i Show a form in which the edges of bent strips enter slots in the studding.

j Has bent strips which occupy depressions in the studding.

k Has means for pinching the edges of the lath. (From Knight's "Mechanical Dictionary.")

Lath (Sheet Iron).—E, in the illustration, shows a sectional view of the lathing. C D, C D show the lathing in position, the dark portions, D D, showing the recesses and "bond," and the light portions, C C, exhibiting the projecting parts of the lathing. The line down the face of



CORRUGATED SHEET IRON LATHING.

the stud A, shows the manner of joining the different sections of the lath; one piece being telescoped into the other, thus forming a complete fireproof joint. The method of securing the lath to the studs, A A, is also shown on the face of the stud A. B shows a portion of the wall completed, with two or three coats of plaster, as the case may be. This lath is manufactured by J. B. & J. M. Cornell, 137 to 141 Centre Street, New York City.

Lathing Clamp.—A clamp to hold a set of spaced laths while nailing to the studding.

Lathing Hammer.—A hatchet whose *bit* and poll present a straight line, so that the bit does not interfere with nailing up laths in corners of rooms. The bit is used for cutting lath to a length, and it has a notch for withdrawing nails.—KNIGHT.

Lath Nail.—A small cut nail, about a fourpenny, used for fastening laths to studding.

Laying.—The first coat of plastering in two-coat work. The surface is made rough by a broom or scratcher to form a key for the next coat.

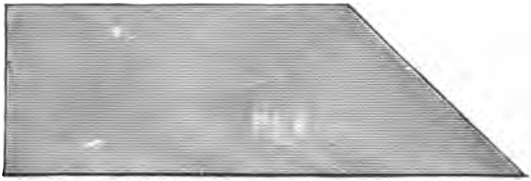
Lime. (Germ. *Leim*, glue).—A most useful earth, obtained by exposing chalk and other kinds of limestones or carbonates of lime, to a red heat, an operation generally conducted in kilns constructed for the purpose, by which the carbonic acid is expelled, and lime, more or less pure, according to the original quality of the limestone, remains, in which state it is called *quicklime.*

Limekiln.—One for the purpose of burning lime. They are constructed in a variety of ways, to save expense, or to answer to the particular nature of the fuel.

Limestone.—A generic term for those varieties of stone containing carbonate of lime, which are neither crystallized nor earthy, the former being calcareous spar, the latter chalk. When burned they yield quicklime.

Mitering Tools.—Sometimes called mitre-rods. They are used by the plasterer to finish up corners, mitres, and other difficult places where fine and exact work is required.

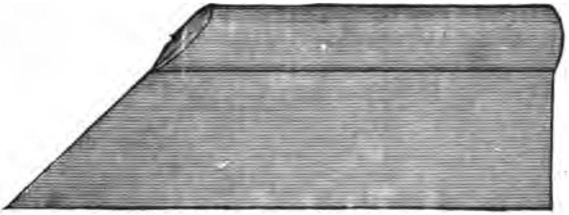
Excellent tools of this kind are made by E. M. Boynton, 80 Beekman Street, New York.



MITRE-ROD.

Moresque Architecture.—The style of building peculiar to the Moors and Arabs. It is also called Saracenic.

The word Moresque is also applied to a kind of painting in that style, used by the Moors. It consists in many grotesque pieces and compart-



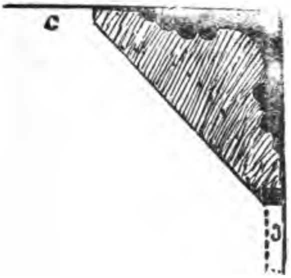
MITRE-ROD WITH WOOD BACK.

ments, promiscuously, to appearance, put together, but without any perfect figure of man or animal. The style is sometimes called *Arabesque.*

Moulds.—Among plasterers, these are made of wood cut the reverse of the moulding intended to be struck. A piece of metal, iron, steel or brass is cut the reverse of the shape of the moulding required, and screwed on the wooden mould.

CENTRE MOULD.

Centre-moulds have a long arm and pin, and are used to run centre-pieces on ceilings.



CORNICE MOULD.

Cornice moulds are made with flat surfaces, one at each extremity, as shown in the annexed cut at *c* and *g*.

Notation, Architectural.—The method adopted of placing signs to figures when marking dimensions on drawings. Thus, in lieu of writing *feet, inches*, and parts of an inch, certain dashes are used, ′ for feet, ″ for inches, and ‴ for parts; or ° for feet, ′ for inches, and ″ for parts. There is no settled method for using these marks.

Octagon.—An eight-sided figure, sometimes used for centre-pieces; it is formed as follows: Let A B (Fig. 1) be the given line. From the extremities A and B erect the perpendiculars A E and B F; extend the given line both ways to *k* and *l*, forming external right angles with the lines A E and B F. Bisect these external right angles, making each of the bisecting lines A H and B C equal to the given line A B. Draw H G and C D parallel to A E or B F, and each equal in length to A B. From G draw G E parallel to B C, and intersecting A E in E, and from D draw D F parallel to A H, intersecting B F in F. Join E F, and A B C D F E G H is the octagon required. Or from D and G as centres, with the given line A B as radius, describe arcs cutting the perpendiculars A E and B F in E and F, and join G E, E F, F D, to complete the octagon. (*See cut*).

Otherwise, thus.—Let A B (Fig. 2) be the given straight line on which the octagon is to be described. Bisect it in *a*, and draw the perpendicular *a b* equal to A *a* or B *a*. Join A *b*, and produce *a b* to *c*, making *b c* equal to A *b*; join also A *c* and B *c*, extending them so as to make *c* E and *c* F each equal to A *c* or B *c*. Through *c* draw C *c* G at right angles to A E. Again,

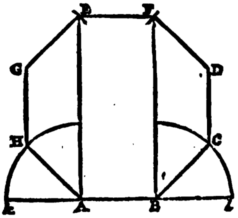


Fig. 1.

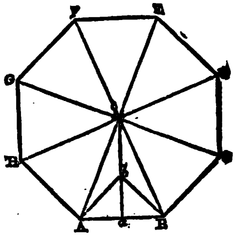


Fig. 2.

through the same point *c*, draw D H at right angles to B F, making each of the lines *c* C, *c* D, *c* G, and *c* H equal to A *c* or *c* B, and consequently equal to one another. Lastly, join B C, C D, D E, E F, F G, G H, H A; A B C D E F G H will be a regular octagon described upon A B, as required.

Ornament.—The smaller and detailed part of the work, not essential to it, but serving to enrich it; it is generally founded upon some imitation of the works of nature.

Parget.—A plaster formed of lime, sand, hair and cow-dung, used for lining the interiors of flues.

Parge Work; Pargetting.—A particular sort of plaster work, having patterns and ornaments raised upon it or indented, much used in interior decorations, and often on the exterior of half-timber houses, during the Elizabethan period.

Patera. (Lat.)—A vessel used in the Roman sacrifices, wherein the blood of the victims was received. It was generally shallow, flat, and circular. Its representation has been introduced as an ornament in friezes and fasciæ, accompanied with festoons of flowers or husks, and other accessories.

Piece Work.—Work done and paid for by measure of quantity, *i.e.*, so much for the piece or job; in contradistinction to work done and paid for by the measure of time, *i.e.*, by day work.

Portland Cement.—A quick-setting cement made from limestone and clay. It is calcined at a very great heat; will take a larger quantity of sand than Roman cement; and is much lighter in color, rendering it more agreeable for decorative purposes.

Pricking-up.—The first coat of plaster on lath; the surface is scratched to form a key for the next coat.

Pugging.—Stuff laid between ceilings or on partition walls to deaden sounds. The material may be mortar, felt, sawdust, tan-bark, or any other suitable stuff.

Rendering.—The first coat of plastering on brickwork. It is followed by the *floating-coat* and the *setting-coat*, the latter being made of *fine* stuff. The first coat is sometimes termed the *pricking-up* coat. When on lath it is said to be laid. *Rendered* and *set* is complete two-coat work on brick or stone.

Roman Cement.—The common name for Parker's cement. It is now very often called "brown cement," to distinguish it from Portland or "white cement."

Romanesque Architecture.—The style which was based upon a Roman form, and which led on to the Pointed or mediæval styles. There are many varieties of Romanesque, as Lombard, Rhenish, French, and English Norman, etc., each having its own independent developments.

Rough-Cast.—A mode of finishing outside work by dashing over the second coat of plastering while quite wet a layer of washed fine gravel or shells mingled with lime and water.

Ruderation. (Lat. *Ruderatio*).—A method of laying pavements, mentioned by Vitruvius, and according to some, of building walls with rough pebbles and mortar. The mortar called *statumen* by Vitruvius was made of lime and sand.

Rule.—A strip or screed of wood or plaster, placed on the face of a wall as a guide to assist in keeping the plane surface.

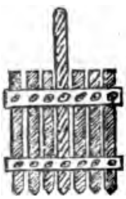
Rule.—An instrument for measuring short lengths. Of rules there are various sorts, each adapted to the class of artificers for whose use they are made. Thus, there are stone-cutters' rules, masons' rules, carpenters' rules, sliding rules, parallel rules, etc. The sliding rule is, however, of more general use, as it solves by inspection a number of questions from the change of the position of the slider, and therefore of much importance to the less educated artisan.

Rural Architecture.—A style of architecture suited for country places, and not strictly conforming to any rules but that, perhaps, of the picturesque.

Sand.—There are three sorts, river, sea, and pit sand. They are mixed with lime and cement in varying proportions. When they can be only procured mixed with earthy and clayey particles, they must be repeatedly washed until the sand becomes bright in color and feels gritty under the fingers. Sea sand must be very well washed in fresh water, and it is doubted by some practitioners whether it can ever be freed from particles of salt, which would prevent the plaster or cement drying.

Scagliola. (Ital.)—A species of plaster or stucco invented at Carpi, in the state of Modena, by Guido Sassi, between 1600 and 1649. It is sometimes called *mischia*, from the mixture of colors introduced in it. It was not, however, until the middle of the eighteenth century that the art of making scagliola was brought to perfection. The following is the method of making columns and pilasters: 'A wooden cradle, composed of thin strips of pine or other wood, is made to represent the column designed, but about 2½ inches in diameter less than the shaft is intended to be when finished. This cradle is lathed round, as for common plastering, and then covered with a pricking-up coat of lime and hair. When this is quite dry, the scagliola artist commences his operations, and, by imitating the rarest and most precious marbles, produces a work which cannot be, except by fracture or sound, discovered to be counterfeit. The purest gypsum which can be obtained is broken into small pieces and calcined. As soon as the largest fragments lose their brilliancy, the fire is withdrawn; the calcined powder is passed through a very fine sieve, and mixed up with a solution of Flanders glue, isinglass, etc. In this solution the colors are diffused that are desired to be imitated in the marble; but if the work is to be of various colors, each color is separately prepared, and they are afterwards mingled and combined nearly in the same manner that a painter mixes the primitive colors on his palette to compose his different tints. When the powdered gypsum is prepared and mingled for the work, it is laid on the shaft of the column or other surface over the pricked-up coat of lime and hair, and it is then floated with proper moulds of wood, the artist during the *floating* using the colors necessary for the imitation, by which means they become incorporated with the surface. The process of polishing follows, and this is done by rubbing the surface with pumice-stone in one of his hands, while with the other he cleans it with cloth. It is then polished with tripoli and charcoal and fine soft linen; and after going over it with a piece of felt dipped in a mixture of oil and tripoli, he finishes with an application of pure oil.—GWILT.

Scratch Work. (It. *Sgraffiata*).—A colored plaster being laid on the face of the building, it is covered with a white one, which being scratched through to any design with an iron bodkin, the colored work appears through and makes the contrast. It is an Italian method of decorating a plain surface, and is now being much carried out in England. A scratch coat, is the first coat of coarse stuff gone over with a *Scratcher*, which gives bond for the next coat.


SCRATCHER.

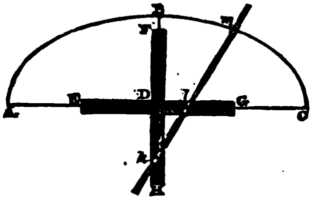
Soffite. Soffit, or Sofite. (Ital.)—A ceiling; the lower surface of a vault or arch. A term denoting the under horizontal face of the architrave between columns; the under surface of the corona of a cornice.

Sound-boarding.—In floors, consists of short boards placed transversely between the joists, and supported by fillets fixed to the sides of the latter for holding pugging, which is any substance that will prevent the transmission of sound from one story to another, such as a mixture of mortar and chopped straw, or sawdust. The narrower the sound-boards the better; the fillets on which they rest may be three-quarters of an inch thick and about an inch wide, nailed to the joists at intervals of a foot. It has been suggested to put an india-rubber washer of about the same width as the joist, between the ceiling joist and the joist, having a thickness of half an inch when properly screwed up, to effect the same object. *See Boarding for Pugging.*

Spandrel.—The irregular triangular space between the outer curve or extrados of an arch, a horizontal line from its apex, and a perpendicular line from its springing. In mediæval architecture they are often filled with figures, medallions, shields, as at York cathedral, or diaper work as at Westminster Abbey. In the Italian style, they are often filled with figures, or compositions relating to the purposes for which the building is erected.—GWILT.

Splay.—A slanting or bevelling in the sides of an opening to a wall for a window or door, so that the outside profile of the window is larger than that of the inside; it is done for the purpose of facilitating the admission of light. It is a term applied to whatever has one side making an oblique angle with the other: thus, the heading joists of a boarded floor are frequently splayed in their thickness. The word *fluing* is sometimes applied to an aperture, in the same sense as *splayed*.

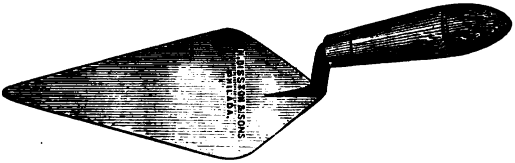
Trammel.—This is an instrument for describing an ellipse, and will often be found useful by the plasterer. It consists of two principal parts, the fixed part in the form of a cross E F G H, and the movable piece or tracer *k l m*. The fixed piece is made of two rectangular bars or pieces of wood, of equal thickness, joined together so as to be in the same plane. On one side of the frame so formed, a groove is made, forming a right-angled cross. In the groove two studs, *k* and *l*, are fitted to slide freely, and carry attached to them the tracer *k l m*. The tracer is generally made to slide through a socket fixed to each stud, and provided with a screw or wedge, by which the distance apart of the studs may be regulated. The tracer has another slider *m*, also adjustable, which carries a pencil or point. The instrument is used as follows:—Let A C be the major, and H B the minor axis of an ellipse: lay the cross of the trammel on these lines, so that the centre lines of it may coincide with them; then adjust the sliders of the tracer, so that the distance between *k* and *m* may be equal to half the major axis, and the distance between *l* and *m* equal to half the minor axis; then by moving the bar round, the pencil in the slider will describe the ellipse.



Trimmed.—A piece of workmanship fitted between others previously executed, which is then said to be *trimmed in* between them. Thus, a partition wall is said to be trimmed up between the floor and the ceiling; a post between two beams; a trimmer between two joists.

Trimmer.—A small beam, into which are framed the ends of several joists. The two joists, into which each end of the trimmer is framed, are called *trimming joists*. This arrangement takes place where a well-hole is to be left for stairs, or to avoid bringing joists near chimneys, etc.

Trowel.—A tool used chiefly by bricklayers for spreading mortar between the joints of bricks when laying.



ROUND-POINT TROWEL.

Sometimes the plasterer makes use of trowels of this kind for pointing, patching, and working in stucco. Two trowels are shown here; these are nearly alike in general form, with the exception of the "points" of the blades. One having a round point and the other a diamond point.

SHARP-POINT TROWEL.

Tuck Pointing.—In old brickwork after it has been well washed and the mortar raked out, the joints are filled with new mortar; the face of the work is then colored yellow or red, as desired. Lines to mark the joints are made by putting on a ridge of lime putty with the point of the trowel over the new mortar, and cutting it straight and to the required width by means of a straight-edge and knife.

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